

# **The Flattening of Sustainment: The Interaction of Technology, Information, Force Structure, and the Emergence of Operational Logistics**

**A Monograph  
by  
LTC Patrick K. Curran  
United States Army**



**School of Advanced Military Studies  
United States Army Command and General Staff College  
Fort Leavenworth, Kansas**

**AY 2009**

<b>REPORT DOCUMENTATION PAGE</b>			<i>Form Approved</i> <b>OMB No. 0704-0188</b>	
<small>Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. <b>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</b></small>				
<b>1. REPORT DATE (DD-MM-YYYY)</b> 30-040-2009		<b>2. REPORT TYPE</b> Monograph		<b>3. DATES COVERED (From - To)</b> July 2008-May 2009
The Flattening of Sustainment: The Interaction of Technology,  Information, Force Structure and the Emergence of Operational Logistics		<b>5a. CONTRACT NUMBER</b>		
		<b>5b. GRANT NUMBER</b>		
		<b>5c. PROGRAM ELEMENT NUMBER</b>		
<b>6. AUTHOR(S)</b>  LTC Patrick K. Curran, United States Army		<b>5d. PROJECT NUMBER</b>		
		<b>5e. TASK NUMBER</b>		
		<b>5f. WORK UNIT NUMBER</b>		
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b>  Advanced Military Studies Program 250 Gibbon Ave Fort Leavenworth,KS 66027		<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>		
<b>9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b>  Command and General Staff College		<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b>		
		<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b>		
<b>12. DISTRIBUTION / AVAILABILITY STATEMENT</b>  Approved for Public Release; distribution is unlimited.				
<b>13. SUPPLEMENTARY NOTES</b>				
<b>14. ABSTRACT</b> The United States' military power and capabilities are singularly enabled by unequalled sustainment capability and reach of our transportation and logistics systems. The current conflicts in Iraq and Afghanistan are highlighting an emerging trend in the operational level of logistics seen in the flattening of Command and Control (C2), theater distribution and the increased use contracted sustainment of operational formations across both Iraq and Afghanistan. Combatant Commanders continue to exercise the authority to maximize logistics resources in their respective theaters to enable favorable Tooth to Tail Ratios (T3R) focused on Combat Forces. The unintended consequence is the shifting of many strategic sustainment capabilities to the operational level of logistics. This shifting of capabilities is making the operational level of sustainment an agent of change. The reduction of the strategic sustainment and industrial base to a reactive provider of logistics and the reduction of the tactical sustainment of units in "the last 1000 yards" to the foxhole will have unintended consequences. The emergence of operational logistics is a recent phenomenon. The collapse of Deterrence and the emergence of The Air Land Battle Doctrine coupled with the Goldwater-Nichols Act set in motion the emergence of operational logistics as we see it today in action in support of Combatant Commands (COCOMS) across the globe. The Department of Defense and its transformational efforts focused on joint modularity, the increased use of Private Military Companies (PMC) providing contracted logistics, and the continued emergence of new information management and digital communications tools has empowered the operational logistician. These factors make the operational level of logistics the center of a growing construct that enables the tactical formation to focus forward on logistics and make reactive the numerous strategic sustainment structures including the industrial base. The monolithic cold war era top down driven logistics structure exists no longer. The introduction of widespread contracts and corporations providing sustainment capability in lieu of military sustainment units has implications for future force structure and sustainment for full spectrum operations.				
<b>15. SUBJECT TERMS</b>				
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>  UNLIMITED	<b>18. NUMBER OF PAGES</b>
<b>a. REPORT</b> UNCLASSIFIED	<b>b. ABSTRACT</b> UNCLASSIFIED	<b>c. THIS PAGE</b> UNCLASSIFIED		
				<b>19b. TELEPHONE NUMBER (include area code)</b> 913-758-3302

# SCHOOL OF ADVANCED MILITARY STUDIES

## MONOGRAPH APPROVAL

LTC Patrick K. Curran

Title of Monograph: **The** Flattening of Sustainment: The Interaction of Technology, Information, Force Structure, and the Emergence of Operational Logistics

Approved by:

---

Jacob W. Kipp, Deputy Director, SAMS

Monograph Director

---

Stefan Banach, COL, IN

Director,  
School of Advanced;  
Military Studies

---

Robert F. Baumann, Ph.D.

Director,  
Graduate Degree  
Programs

## **Abstract**

THE FLATTENING OF SUSTAINMENT: THE INTERACTION OF TECHNOLOGY, INFORMATION, FORCE STRUCTURE, AND THE EMERGENCE OF OPERATIONAL LOGISTICS by LTC Patrick K. Curran, USA, 71 pages.

The United States' military power and capabilities are singularly enabled by unequalled sustainment capability and reach of our transportation and logistics systems. The current conflicts in Iraq and Afghanistan are highlighting an emerging trend in the operational level of logistics seen in the flattening of Command and Control (C2), theater distribution and the increased use of contracted sustainment of operational formations across both Iraq and Afghanistan. Combatant Commanders continue to exercise the authority to maximize logistics resources in their respective theaters to enable favorable Tooth to Tail Ratios (T3R) focused on Combat Forces. The unintended consequence is the shifting of many strategic sustainment capabilities to the operational level of logistics. This shifting of capabilities is making the operational level of sustainment an agent of change. The reduction of the strategic sustainment and industrial base to a reactive provider of logistics and the reduction of the tactical sustainment of units in "the last 1000 yards" to the foxhole will have unintended consequences.

The emergence of operational logistics is a recent phenomenon. The collapse of Deterrence and the emergence of The Air Land Battle Doctrine coupled with the Goldwater-Nichols Act set in motion the emergence of operational logistics as we see it today in action in support of Combatant Commands (COCOMS) across the globe. The Department of Defense and its transformational efforts focused on joint modularity, the increased use of Private Military Companies (PMC) providing contracted logistics, and the continued emergence of new information management and digital communications tools has empowered the operational logistician. These factors make the operational level of logistics the center of a growing construct that enables the tactical formation to focus forward on logistics and make reactive the numerous strategic sustainment structures including the industrial base. The monolithic cold war era top down driven logistics structure exists no longer. The introduction of widespread contracts and corporations providing sustainment capability in lieu of military sustainment units has implications for future force structure and sustainment for full spectrum operations.

# TABLE OF CONTENTS

Abstract .....	iii
Illustrations .....	v
Introduction .....	1
Methodology .....	5
Defining Operational Logistics .....	10
From Napoleon to World War I .....	12
New Formations but Old Logistics.....	12
The Growth of the Headquarters .....	14
Logistical Innovations and the U.S. Civil War.....	16
World War I and the Failure to Operationalize Logistics.....	18
The Interstate Industrial War.....	23
The Polish Campaign of 1920 – Emergence of Operational Art and the Failure of Operational Sustainment .....	25
“What Could be” – Operation Barbarossa.....	27
The 90 Division Army and Today’s Army.....	29
Deterrence and Air-Land Battle .....	33
The Deterrence Era and Operational Logistics.....	34
Everything is Strategic .....	35
C4 Centralization.....	36
Air land battle and DOTMLPF.....	37
Kuwait to Iraq.....	40
Tooth to Tail Ratios (T3R) .....	42
Modularity and the Generating Force.....	45
The Emergence of Private Military Companies as the Default Sustainer .....	48
The United States and the Future of Operational Logistics.....	51
Conclusion.....	54
Recommendations .....	59
BIBLIOGRAPHY .....	62

# Illustrations

	Page
Figure 1. 2004 to Present (Expansion of Operational Logistics) .....	4
Figure 2. Elements of Operational Design .....	7
Figure 3. From Napoleon to World War I.....	22
Figure 4. 1918 to 1944 .....	32
Figure 5. Operational Logistics 1950 to 1986.....	40
Figure 6. T3R 1918 to Vietnam.....	44
Figure 7. T3R Ratio 1986 to Iraq .....	45
Figure 8. Flattening of C2 Structures .....	47
Figure 9. Operational Logistics 1991 to Present .....	53
Figure 10. “Operational Logistics Realized” .....	55
Figure 11. 2004 to Present (Expansion of Operational Logistics) .....	59

# Introduction

One must be fully aware both of contemporary achievements in military equipment and trends in the further development of every type of weapon. Otherwise, one cannot understand those changes that may occur in the organization of armies in the near future.<sup>1</sup>

– V.K. Triandafillov

Someone at Wal-Mart must have taken over the logistics of the U.S. Military.<sup>2</sup>

– Victor Davis Hanson

The United States' military power and capabilities are enabled by the unequaled sustainment capability and reach of our transportation and logistics systems. The current conflicts in the Middle and the Near East are highlighting an emerging trend in the operational level of logistics seen in the flattening of distribution, acquisition, contracting, and sustainment of operational formations across both Iraq and Afghanistan.<sup>3</sup> Combatant Commanders continue to exercise the authority to shift logistics resources in their respective theaters. The ballet between the combatant commands, the generating force, and the requirement of operations to maximize the greatest amount of sustainable combat power on the ground highlights the efficiencies and the unique capabilities emerging at the operational level of logistics.<sup>4</sup> The combatant command and its joint logistics capability is where at the operational level that strategic and tactical capabilities, processes, and requirements intersect.<sup>5</sup>

---

<sup>1</sup>V.K. Triandafillov, *The Nature of the Operations* (London: Rutledge Press, 1994), 9.

<sup>2</sup>Victor Davis Hanson, "The Good--Part III," Blog, March 30, 2009, <http://pajamasmedia.com/victordavishanson/784/> (accessed April 6, 2009).

<sup>3</sup>James J. Schneider, Theoretical Paper No. 3, *The Theory of Operational Art*, 2nd issue (School of Advanced Military Studies, Fort Leavenworth, KS, March 1988), 12. Dr. Schneider on page 22 defines logistics as providing the military artist with the operational substance for use in war. He continues to state that logistics, the chief element of combat service support, is divided into primary categories: sustainment and transportation.

<sup>4</sup>Operational Logistics is defined into two primary categories: sustainment and transportation. Sustainment is supply, maintenance and shelter of operational forces. Transportation is the services related to the movement and movement planning of units and materials. Though Operational Logistics is divided into sustainment and transportation, the terms "Logistics" and "Sustainment" will be used interchangeably.

<sup>5</sup>Joint Chiefs of Staff, Joint Publication (JP) 4.0, *Joint Logistics* (Washington, DC: Government Printing Office, 2008). V. Executive Summary states Joint logistics spans the strategic, operational and tactical levels of war. It is, however, at the tactical level where the principal outcome-- sustained logistic readiness--of joint logistics must be measured. At the strategic level, joint logistics is characterized by the

There continues to be the shifting of many strategic sustainment capabilities to the operational level of sustainment that is making the operational level of logistics an agent of change. This reduces the strategic sustainment and industrial base to a reactive provider of logistics and focuses the tactical sustainer logistics the foxhole will have unintended consequences. To maximize that amount of combat forces on the ground versus military logistics assets and increase the amount of teeth in the Tooth to Tail Ratio (T3R) there is an increasing use of Private Military Companies (PMC) to provide like or similar capabilities of supporting combat forces on the ground.<sup>6</sup> The use of PMCs on the battlefield is not a new development but the scale seen today is unsurpassed in the amount of PMCs and the dollar expenditures.<sup>7</sup>

The emergence of operational logistics is a recent phenomenon. What has enabled this emergence in the flattening and strengthening of operational sustainment is the force structure changes focused on the interchangeable logistics structures which the Army in 2004 and the Department of Defense in 2008 calls modularity. Modularity means combat and sustainment forces are self-sustainable and flexible, reducing layers of command and control (C2).<sup>8</sup> New information management and digital communications tools and increased reliance on contracted

---

vast capacity of the Nation's industrial base, both government and commercial. At the operational level, joint logistics has its most significant impact. It is at the operational level that strategic and tactical capabilities, processes, and requirements intersect, and it is here where the essence of joint logistics resides. The tactical level represents that part of the operational environment where outcomes are realized. At the tactical level, logistic support is Service oriented and executed.

<sup>6</sup>John J. McGrath, *The Other End of the Spear: The Tooth-to-Tail Ratio (T3R) in Modern Military Operations*, The Long War Series Occasional Paper 23 (Fort Leavenworth, KS: Combat Studies Institute Press, 2007), 2. McGrath defines T3R as the number of troops in a military organization employed in combat duties versus the number functioning in noncombat roles.

<sup>7</sup>Deborah C. Kidwell, *Public War, Private Fight? The United States and Private Military Companies*, Global War on Terrorism Occasional Paper 12 (Fort Leavenworth, KS: Combat Studies Institute Press, 2005), 1. Deborah Kidwell defines Private Military Companies (PMC) as Corporate Profit Driven organizations that provide service like capabilities to the Armed Forces. These services in the logistics world include the building of infrastructure, provide transportation and sustainment and security. Kellogg Brown and Root now known as KBR, The Flour Corporation and others as PMCs.

<sup>8</sup>Department of Defense, The Budget for Fiscal Year 2007, <http://origin.www.gpoaccess.gov/USbudget/fy07/pdf/budget/defense.pdf> (12 April 2009).



logistics capability and sustainment continues to flatten and strengthen the operational level of logistics.

These factors make the operational level of logistics the center of a growing construct. This growing construct enables tactical formations to focus on logistics at the battalion level forward and makes reactive the numerous strategic sustainment structures interacting with the operational level of sustainment. The industrial base is now becoming more and more reactive in a cellular manner instead of monolithic cold war era top down driven structure. The operational level of sustainment is dominant in not only supporting the tactical sustainer but also forcing structural change upward to the strategic and industrial sustainment base.

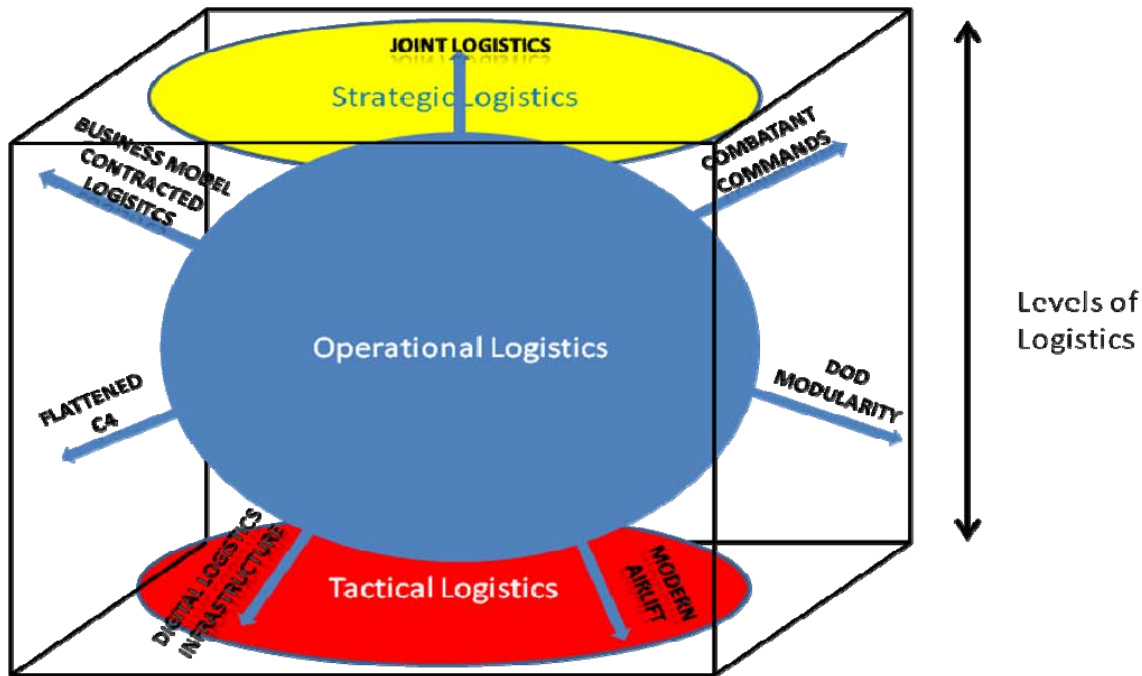
The introduction of widespread contracting and for profit driven corporations providing sustainment capability in lieu of military sustainment units has major implications for future force structure and sustainment for full spectrum operations. This expansion has compressed the tactical and strategic level of sustainment while not minimizing their importance and making the influence of the operational level sustainment extend from the end of the factory assembly line or the end of the runway of Charleston Air Force Base to the actual execution in the immediate rear of the deployed unit (See figure 1).

What makes the expansion of the operational level of sustainment problematic is the potential risk that is incurred by the use of contracting for logistics to maximize the amount of teeth in the operational commander's formations. This "commercial" logistics force structure is not available for deployment into a non-permissive combat environment and puts the deployed operational force at risk. The trade off financial savings versus expensive force structure is a leadership decision that General Rupert Smith calls, "the fight to preserve the force." Western militaries must maximize the balance of the force as personnel costs represent up to 50 percent of a defense budget.<sup>9</sup> A conservative estimate for adding 10,000 soldiers, sailors, airmen and

---

<sup>9</sup>Rupert Smith. *The Utility of Force: The Art of War in the Modern War* (New York, NY: Vintage Books, 2008).

marines to the force structure is \$1.2 billion per year.<sup>10</sup> What becomes critical for both the generating force decision makers and operational commanders is that a proper balance of force structure must exist to enable an operational commander to sustain their formations in any combat environment.



### 2004 to Present (Expansion of the Operational Sphere of Logistics)

Figure 1. 2004 to Present (Expansion of Operational Logistics)

Source: David S. Alberts, John J. Garstka, Richard E. Hayes, and David T. Signori, *Understanding Information Age Warfare* (Washington, DC: DOD Command and Control Research Program (CCRP), 2001), 108.<sup>11</sup>

<sup>10</sup>James J. Carafano, *Private Sector, Public Wars. Contractors in Combat--Afghanistan, Iraq and Future Conflicts* (Westport, CT: Praeger, 2008), 54. The Figure is also stated in Congressional Budget Office Estimates for FY 2007 (October 2006). Additionally, The International Institute for Strategic Studies, *Expanding the US Army* 13, no 1 (February 2007), uses this figure based on the CBO estimates from October 2006. This number is considered on the low side of estimates as it does not account for the rising cost of health care or the facilities, barracks, and housing required for the additional end strength.

<sup>11</sup>This diagram technique demonstrates the forces that are contributing to the expansion of the operational sphere of logistics. Modern airlift represented by the C17 and commercial tender ex-Soviet platforms like the Il-76 and An-120 (contracted air) are enabling operational logistics at strategic distances. Department of Defense Modularity efforts are focused on flexible interchangeable formations that flatten the technical and support structure reducing the layers of support at the operational level. The Digital Logistics Infrastructure is the internet in a box similar to the Very Small Aperture Terminal (VSAT) and

One of the first thinkers of Operational Art who is critical to the gestation of thinking conceptually about the operational level of war is one of the Soviet inter-war theorists, General Aleksandr A. Svechin. Svechin in his 1924 work, *Strategy*, writing about the unrealized potential of mass industrial war, states that “tactics and administration are the material of operational art and the success of the development of an operation depends on both the successful solution of the individual tactical problems by the forces and the provision of all the material they need to conduct an operation without interruption until the ultimate goal is achieved.”<sup>12</sup> Forwarding General Svechin’s comments 85 years into the future, there is still tremendous pertinence to the relevancy and truth of his statement. The continued interaction of transportation and information technology, force structure development, and improved command, control, communications and computers (C4) systems is creating a powerful construct in the realm of operational logistics which in turn is blurring the lines of sustainment from strategic to the tactical level of warfare.

## Methodology

To determine the validity of the expansion of the operational level of logistics and to demonstrate that the operational level of sustainment is an agent of change there will be three Elements of Operational Design applied to four case studies. Three of the four case studies are historical in nature and will demonstrate the growth of the operational level of logistics. The case studies illustrate the growth of operational logistics and sustainment that one sees today on the

---

portable server and satellite capability of the Joint Network Nodes (JNN). The PMCs are providing Business Model Contracted Logistics. Flattened C4 is the flattening of the technical and sustainment C2, communications and computers.

<sup>12</sup>Aleksandr A. Svechin, *Strategy* (Minneapolis, MN: Eastview Press, 1992), 69. There will be continued use of the concepts of the Soviet military theorists from the interwar period. The gestation of the operational level of war and the codification of the lessons learned from the Napoleonic period forward captured the departure from the great battle of annihilation to one of attrition and exhaustion that must be addressed operational level commanders conducting successive operations in multiple theaters sometimes independently.

battlefields of Iraq and Afghanistan.<sup>13</sup> The fourth case study, though historical in nature, will be the counter argument to the growth of operational logistics and posit that the three levels of logistics stay constant and the importance of each level depends on the part of the spectrum of war that you are observing.

The three elements of Elements of Operational Design are operational reach, simultaneity, and depth (see figure 2).<sup>14</sup> The selection of reach is to evaluate logistics and the transportation and communications technology as they have developed over time. Simultaneity and Depth, though end state focused on the defeat of the enemy, were selected for the direct effect that logistics has on enabling both reach and simultaneity through C4, transportation technology, force structure, and information. To focus the case studies even further, examination will exclusively focus on the sustainment of ground forces. The last case study will exclusively look at the United States Army and its lead in sustainment of the Iraqi and Afghani Theater of operations.

---

<sup>13</sup>The case studies are very ground forces centric and in turn are very focused on U.S. Army sustainment and the implied Title 10 Service Specific requirement to be the Service lead for logistics and sustainment as the ground component lead.

<sup>14</sup>Joint Chiefs of Staff, Joint Publication (JP) 5-0, *Joint Planning Manual* (Washington, DC: Government Printing Office, 2006), 129. Operational reach is the distance and duration across which a unit can successfully employ military capabilities. Reach is fundamentally linked to culmination, the point in time at which the force can no longer attack or defend successfully. Although reach may be constrained or limited by the geography in and around the OA, it may be extended through forward positioning of capabilities and resources, increasing the range and effects of weapon systems, leveraging HNS and theater support contracting support, and maximizing the throughput efficiency of the distribution architecture. Page IV-23, Operational *Simultaneity* refers to the simultaneous application of military and nonmilitary power against the enemy's key capabilities and sources of strength. Operational Depth seeks to overwhelm the enemy throughout the OA, creating competing and simultaneous demands on enemy commanders and resources and contributing to the enemy's speedy defeat, IV-24.

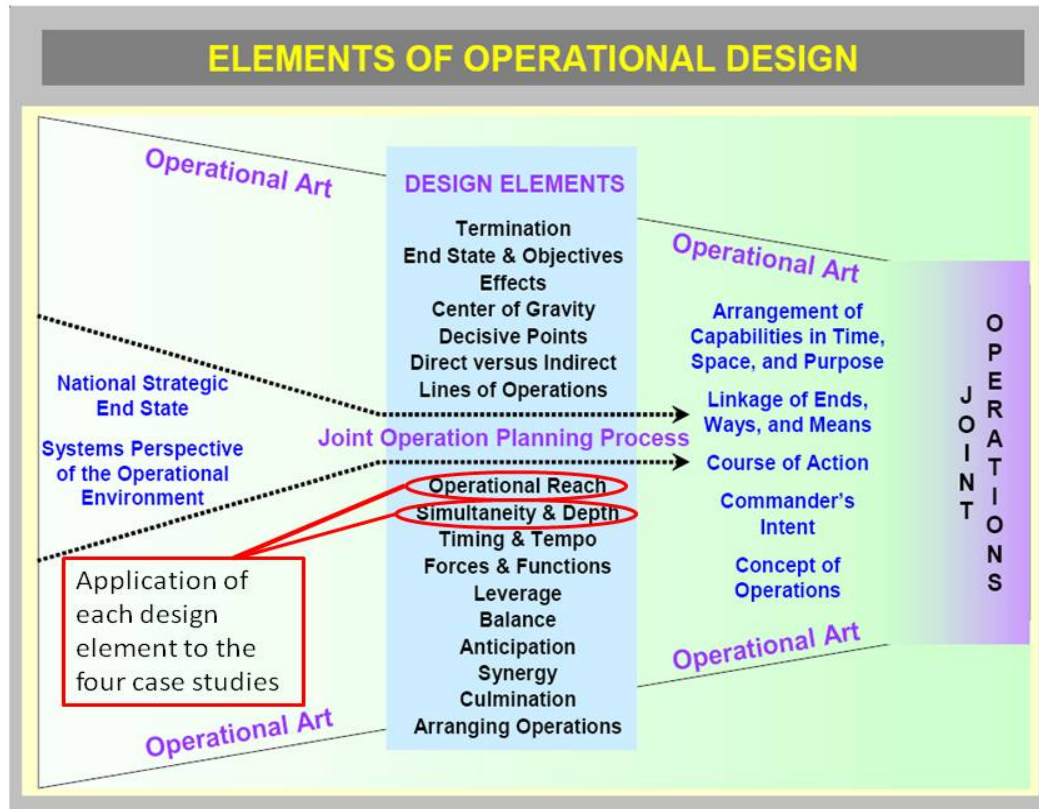


Figure 2. Elements of Operational Design

Source: Joint Chiefs of Staff, Joint Publication (JP) 5-0, *Joint Planning Manual* (Washington, DC: Government Printing Office, 2006), IV-5

To develop the background to the expansion of operational sustainment there is a need to define the terms and terminology essential to the critical examination of the continuing expansion of the operational level of sustainment vice the strategic and the tactical. The first historical case study, **Napoleon to the World War I**, will focus on the force structure and technological innovations that lay the groundwork for operational logistics. These force structure changes and technological innovations will have the elements of reach, simultaneity, and depth applied to them to discern the emergence of sustainment trends. Specific examination will be applied to the sustainment of the new formations of the Napoleonic era to the mass consumption and the million

man armies of conscription that would begin to change the sustainment paradigm ending with World War I.<sup>15</sup>

The second case study, **The Interstate Industrial War**, is centered on the interwar period leading up to nuclear age. It is a very applicable description because elements of operational logistics begin to emerge through the full motorization and mechanization of armies that took place culminating towards the end of World War II.<sup>16</sup> As the elements of reach, simultaneity, and depth are applied, they will determine if operational sustainment was relevant during this timeframe. One campaign that will be examined is the first realized operational level campaign from the Russian Civil War, the “Drive to the Vistula” of the Soviet--Polish war of 1920. Additionally a critical look will be taken of Martin Van Creveld’s assertion that the sustainment of Operation Barbarossa failed for not only the reasons well stated by historians but that it was not sustainable logistically based on the lack of motorization of the Wehrmacht and its supporting arms.<sup>17</sup> Finally, examining the foundations laid down by General Wedemeyer’s fully mechanized and motorized 90 division Victory Army of World War II is key to how long term sustainment trends begin with the establishment of this force. There are still vestiges of the Victory Army today in the United States Army whether in the generating force or in the current composition of forces.<sup>18</sup>

---

<sup>15</sup>Correlli Barrett, *The Sword-Bearers: Supreme Command in the First World War* (New York, NY: William Morrow and Co, 1964), 1-98. Similar to the flaw of the lack of headquarters between armies and OHL in the case of the Germans there did not exist similar organizations that could keep up with the new consumption figure of modern artillery and machine gun use.

<sup>16</sup>Smith, *The Utility of Force*, 30-149. General Smith used the term to describe the essentially the beginning of modern warfare as we know with Napoleon and his innovations in organization, military thought and mobility built upon the “Levee en Mass.” The period ends in 1945 with the use of atomic weapons. He discusses at length the beginning of industrialized warfare in the mid-1800s (i.e. the assembly line Colt Pistol) and the development of the European transportation networks that enable the multi-million man armies to be brought to bear on any front quickly by the thousands of kilometers of new railroads.

<sup>17</sup>Martin Van Creveld, *Supplying War; Logistics from Wallenstein to Patton* (Cambridge UK: Cambridge University Press, 1977), 142-180. Van Creveld addresses the problems of the Wehrmacht and their semi-motorized and the immature logistics systems that attempted to sustain their offensive in 1941 and posits that that Barbarossa was flawed based on the logistics failures of the campaign.

<sup>18</sup>John J. McGrath, *The Brigade: A History; Its Organization and Employment in the United States Army* (Fort Leavenworth, KS: Combat Studies Institute Press, 2004), 134-135. The DNA of the Victory

**Deterrence and Air Land Battle** will span the period of Atomic Weapons at the end of World War II, the collapse of Deterrence, and the Emergence of Air Land Battle in the United States Army in the late 1970s and early 1980s. Though there is continued emergence of operational sustainment during this time, operational logistics does not begin to coalesce and take shape until the Soviet and US Operational Renaissance of the Deep Battle/Air-Land Battle. This intellectual growth away from the strategic escalation of all things tactical in the nuclear age enables operational logistics to take root.<sup>19</sup> Application of the elements of reach, simultaneity, and depth will start to demonstrate that operational logistics is emerging but not fully realized. The rediscovery of the Soviet interwar theorists fundamentally changed the awareness and scope of how we see the operational level of war.

The final case study will focus on the **Kuwait, Bosnia, and Baghdad**, a period from the early-1990s onwards. Here there is the shift that begins to take place with logistics in the first Gulf War away from the mountains of iron and begin to see combatant commanders exercise operational logistics in their areas of operations.<sup>20</sup> Operational logistics are realized by the beginning of the Long War on Terror and continue with ongoing operations in Afghanistan and Iraq. Tooth to Tail Ratio (T3R), Department of Defense's modularity efforts, and the emergence of the PMC as the default sustainer are all contributing to the emergence and strengthening of operational logistics. General A. A. Svechin's operational tenets still apply and the technological innovations emerging today are still pertinent to the building of the proper force in the right

---

Army can still be seen in the structure of the Modular Brigade and its similarity to the Combat Command of the 1944 Armored Division. Additionally, the United States Army's organization into Combat, Combat Support and Combat Service Support began to develop with the establishment of the 90 Division Force and the associated units that enable the divisions to function when organized as CORPS, Armies and Army Groups. the generating structures required to sustain the force

<sup>19</sup>General Don Starry, Letter to Dr. Richard Swain, his comments to Dr. Swain on his recently published article, *Filling the Void*, dated 7 June 1995, pages 2-3, discusses the employment of tactical nuclear weapons in the mid-1950s and almost the inevitable and quick use of strategic nuclear weapons once the tactical fighting and subsequent use of tactical nuclear weapons began.

<sup>20</sup>A Mountain of Iron is a term used in the United States Army for large and vast stockages of repair parts, supplies and equipment usually in a rear area location.

quantity and the right quality. Specifically, how the interactions of information and communications technologies and their effects on speed, mass, lethality, sustainment, and transportation networks impact on the operational level of logistics. This will lead to a discussion on how the interaction of the organization of forces (i.e. the Generating Force), the industrial base, and technology, changes the dimensional dynamics of operational depth to more a spatial understanding departing from the traditional two-dimensional views of the three levels of warfare.

## Defining Operational Logistics

Logistics is the final Arbiter of operations.<sup>21</sup>

– Dr. James J. Schneider

Svechin defines Operational Art and the operational level of war as the bridge between tactics and strategy specifically stating; “Strategy pursues goals and tactics solve problems . . . . tactics make the steps which operational leaps are assembled, strategy points out the path.”<sup>22</sup> Complementing Svechin’s statement is Joint Publication (JP) 3.0, *Joint Operations*, which states that, “Operational Art integrates ends, ways, and means across the levels of war . . . to facilitate the integration of other agencies and multinational partners towards achieving the national end state.”<sup>23</sup> Further drilling down, The United States Army Field Manual 3.0, *Operations*, discusses Operational Art and the critical task of Operational Design as the, “Bridge between strategic end state and the execution of tactical tasks.”<sup>24</sup> Or as JP 3.0 simply states, “as relating tactical tasks to the strategic end state.”<sup>25</sup>

---

<sup>21</sup>Schnieder, *The Theory of Operational Art*, 22-23.

<sup>22</sup>Svechin, footnote 1, page 68; and David A. Glantz and Jonathan House, *When Titans Clashed: How the Red Army Stopped Hitler* (Lawrence, KS: University Press of Kansas Press, 1995), 8.

<sup>23</sup>Joint Chiefs of Staff, Joint Publication (JP) 3.0, *Joint Operations* (Washington, DC: Government Printing Office, 2006), IV-3.

<sup>24</sup>Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2008), 6-1.

<sup>25</sup>Joint Chiefs of Staff, Joint Publication 3-0, *Joint Operations*, IV-14.



Logistics at the operational level resides in the physical domain of war. Dr. James Schneider states the physical domain of war is concerned with the whole process of destruction: the effects of weapons and munitions, the effects of terrain, the effects of weather, logistics, and other physical factors that affect the battle.<sup>26</sup>

Since operational sustainment implies structured military formations, one must address the cybernetic factor of an army or armed forces' cohesion. The cybernetic factor is defined as the organization, command, control, communications, and information that contribute to cohesion. Cohesion is important as this gives an organization its structure and basic shape.<sup>27</sup> This critically ties into General Triandifilov's commentary on force structure and the requirement to be aware that trends in military technology and integrating new technologies into cohesive and appropriate force structure. Triandifilov flatly states, "Otherwise, one cannot understand those changes that may occur in the organization of armies in the near future."<sup>28</sup>

Baron Jomini defined logistics, "as the practical art of moving armies" and this very practical definition is applicable today as a major tenet of operational logistics.<sup>29</sup> Martin Van Creveld builds upon this definition, by stating logistics is, "the practical art of moving armies and keeping them supplied."<sup>30</sup> Dr James Schneider states flatly that, "Logistics is the final Arbiter of operations" and defines in logistics, ". . . virtually anything that makes a physical contribution to combat power can be considered to belong in the realm of logistics." Operational Logistics is defined into two primary categories: sustainment and transportation. Sustainment is supply,

---

<sup>26</sup>Schnieder. *The Theory of Operational Art*, 6. There are three domains of war: Physical, Cybernetic, and Moral.

<sup>27</sup>Ibid.

<sup>28</sup>Triandifilov, *The Nature of the Operations*, 9.

<sup>29</sup>Antoine H. Jomini, *The Art of War* (Westport, CT: Greenwood Press). First Published in 1862. Translated from French by CPT G.H. Mendell and LT W.P. Craighill, 11. Baron Jomini is a great departure point in defining operational logistics. We are an Army firmly rooted in the prescriptive tenets of Baron Jomini. Our doctrine is rooted more in Jomini's interpretation of Clausewitz. His Summary of the *Art of War* reads somewhat like the tenets of the operational Level of war listed in the post active defense FM 100-5 of the General Starry era of TRADOC.

<sup>30</sup>Van Creveld. *Supplying War*, 1.

maintenance, and shelter of operational forces. Transportation is the services related to the movement and movement planning of units and materials.<sup>31</sup>

Finally A. A. Svechin from his intellectual rigors and experience from the Great War, the Russian Civil War and specifically the Soviet-Polish War, highlights the need for strongly emphasizing the role of transportation and movement of logistics from the railhead. Svechin states the role of transportation and transportation's integration in force structure is critical to the operational level of war linking to the strategic level of war.<sup>32</sup>

## From Napoleon to World War I

### New Formations but Old Logistics

The contribution of Napoleon Bonaparte to modern warfare is immense. Unity of Command, mobility, and comprehensive planning are some of the hallmarks of the Napoleonic period.<sup>33</sup> The conceptual leaps in organization of the Division and the Corps and the emergence of the staff were not matched in how one sustained armies in the field. The Russian Campaign of 1812 was still based on the forage limitations of the Smolensk highway leading to Moscow, which was not supported by the depots and magazine system of central and western Europe. The grand Armée' failed in no small part due to the inability to sustain itself.<sup>34</sup> The logistics

---

<sup>31</sup>Schnieder, *The Theory of Operational Art*, 22.

<sup>32</sup>Triandifillov, *The Nature of the Operations*, xv of the Foreword. Dr. Jacob Kipp's Foreword of Triandifillov's, *The Nature of the Operations of Modern Armies*, gives a summation of tenets of Operational Art laid forth by Svechin from his intellectual rigors and experience from the Great War, the Russian Civil War and the Soviet-Polish War. Kipp states, "His main points can be summarized as the following: (1) the establishment of a political-economic foundation beneath a strategy; (2) a division of strategy into two ideal types: attrition (izmor) and destruction (sokrushenie); (3) the delineation of operational art and the assertion of radically new understanding of the concept of operations; (4) a reduction of the role of combat; (5) denial of the importance of the single decisive engagement and the transformation of combat into an ongoing episodic process; (6) radical reduction of march-maneuver as a strategic factor; (7) emphasizing the role of transportation and communications in strategy and the significance of military-technical superiority."

<sup>33</sup>J.F.C. Fuller, *The Conduct of War: 1789-1961* (New York, NY: De Capo Press, 1992), 42-56. J.F.C. Fuller's work is concentrated on the emergence of total war and the impacts Napoleon, the American Civil War and World War I had on total warfare.

<sup>34</sup>Svechin, 179. Svechin was discussing the quality versus quantity that manning an army faces and the day to day implications of sustaining that force.

innovations that emerge from this period are few when compared to the innovations that emerged from the era of limited warfare and Frederick the Great. Frederick the Great's system of supply by column, depots, and contractors was the model of sustainment for the armies of this era. The supply column and depot reinforced the ability of the army not to forage in the countryside and provide some ability to sustain beyond the pillaging of the local village.<sup>35</sup>

Napoleon Bonaparte's capitalization and further refinement of the nascent Division and Corps Structure enabled a scope of operations that was previously unrealized. Logistics reach was still determined by the depth of the depot and magazine system of the armies on the march along their lines of communications. Independent operations led by other commanders was possible during the campaigning season in Europe and elsewhere. Simultaneity of logistics support was limited, like the armies they supported, to the speed of the horse drawn wagon and the foot march. Still, the conceptual understanding of converging independent forces within a day's march of each other could not be supported by foraging alone. The supply train supporting a Napoleonic division and corps was enabled for the speed march that was essential for convergence of forces and initiative.<sup>36</sup>

Logistics in the Napoleonic period was limited to the horse, wagon, depot, and line of march. The cognitive leap on army organization was being made but technology did not exist to support the new formations that were still limited to speed of march and mounts of the cavalry. The three elements of reach, simultaneity, and depth logistically remain unchanged and similar to the limited wars of the King's of Europe. Still one difference introduced is the detailed attention planning receives in the Napoleonic system. Napoleon's Chief of Staff, General Berthier moved the Grand Armee 140 kilometers in four weeks then an astounding achievement, "Each Corps had a designated march route. Supplies were assembled in advance of the march of troops while in

---

<sup>35</sup>Fuller, 22.

<sup>36</sup>Ibid., 42-56.

friendly territory. In some instances soldiers, especially the Imperial Guard rode wagons instead of walking.”<sup>37</sup>

The development of the European infrastructure enabled a level of supply above foraging in the development of depots and rear area troops to operate the line of communication there was not a cognitive jump similar to the development of the Corps structure. The quartermaster on the new corps staff, though Napoleonic in character, was to coordinate for the supply and transportation needs of the Corps. Still, the growth of the quartermaster section was evolutionary and continued the growth that started as an extension of Frederick the Great’s personal staff and his appreciation of the challenges of campaigning and storage of materials necessary for the campaign season.<sup>38</sup>

### **The Growth of the Headquarters**

The staffs created by commanders in the time of the limited wars of Frederick the Great were personal affairs focused on the administration of small forces and the household of the leader. There was generally no special training.<sup>39</sup> The advent of the Grand Armee and the flexible systems of Corps led to the slow emergence of the staff as a concept requiring skill sets and training. Napoleon’s Chief of Staff, Berthier, is a great example of this transformation. General Berthier organized the Grand Armee staff to translate and disseminate complex plans to subordinate Corps and identify requirements to the governing organizations of Imperial France. General Smith uses the term the “central nervous system” but the key fact is that Napoleon began to move far away from the personal household staffs as the staffing system took root downward through the Grand Armee to the corps and even division level.<sup>40</sup>

---

<sup>37</sup>Robert M. Epstein, *Napoleon’s Last Victory: 1809 and the Emergence of Modern War* (Fort Leavenworth, KS: School of Advanced Military Studies Printing, 1992), 47.

<sup>38</sup>Smith, *The Utility of Force*, 54-55.

<sup>39</sup>Ibid.

<sup>40</sup>Epstein, *Napoleon’s Last Victory*, 43.

The Grand Armee of 1805 provides an example of the maturation of the staff. Each Corps and Division Commander had a functioning staff with each having a chief of staff with department heads for logistics, intelligence, troop movements, artillery and engineers. The Grand Armee of 1805 was structurally different from the Austrians, Russians, and Prussians who were still using staffs similar to that of Frederick the Great did in the previous century. Still, it did not take long for the allies to adopt the staff model of the Grand Armee. The concept of the staff took root in the Prussian Army and after the defeat in the Battle of Jena in 1806, which led to the establishment of the Prussian General Staff and the education system of the “Kriegsakademie” system that forms the basis for the modern general staff today.<sup>41</sup>

The next maturation of the staff system in warfare took place in the United States (U.S.) Civil War of 1861-1865, with the need to control systemically at first the hundreds of thousands and subsequently millions of men under arms. The logistics demands on the staff increased with the amount of materials needed by these formations. The Confederate Army established a set of staff structures and the Northern Army laggardly followed suit. By 1864, these armies each faced each other with set corps structures and staffs. The day-to-day corps staff by 1864 was composed of a chief of staff, chief of ordnance, inspector general, adjutant general, quartermaster, and commissary of subsistence.<sup>42</sup>

Logistics became meshed in the daily staff function of the Corps. In fact, the Quartermaster of the Union Army, General Montgomery Meigs, was one of the earliest Union advocates of the corps staff for the efficiencies in sustainment it would enable. It would no longer be a crisis ad hoc affair to manage sustainment of the forces in the field. The management of the

---

<sup>41</sup>Arden Bucholz, *Moltke, Schlieffen and Prussian War Planning* (Providence, RI: Berg Publishing, 1993), 22-23. To define the Kriegsakademie system, General Helmuth Von Moltke, the Senior personally selected the sharpest graduates of the Kriegsakademie for additional training on the German General Staff (GGS).

<sup>42</sup>Robert E. Epstein, “The Creation and Evolution of the Army Corps in the American Civil War,” *The Journal of Military History* 55, no. 1 (January 1991): 39. <http://www.jstor.org/stable/1986127?seq=1>.

Corps, Division, and Brigade trains and movement of supplies from either railhead or port was critical to the sustainment managed and organized by a designated staff.<sup>43</sup>

The Prussian General Staff system continued to develop, mature and blossom with the fruits of the system harvested in the Franco-Prussian War of 1870-1871 leading to the beginning of World War 1. In fact, by 1870 there was a Kriegsakademie trained Chief of Staff with each corps commander in the Prussian. Dedicated quartermaster officers and their staff sections could now transcend the forage level of logistics and the limits of the accompanying brigade, division, and corps trains and columns.<sup>44</sup> Still the sustainment of armies in the field was dependent on the horse and wagon and the movement of materials from the railhead to the forces needing subsistence and the materials of war.

### **Logistical Innovations and the U.S. Civil War**

The U.S. Civil War harkened two revolutionary innovations in sustainment. Those two innovations were the extensive use of the railroad and the military employment of the telegraph. In the past, these two innovations had impacted on the strategic level of sustainment. Simply put, both railroads and the telegraph had a role in the strategic employment and sustainment of forces.<sup>45</sup> The link to operational level more tenuous and limited to what also limited Frederick the Great and Napoleon struggled; was the horse and the supply train.

General Henry Halleck in his ad hoc role as the Union Army Chief of Staff lamented after the Union victories of Antietam, Perryville, Iuka, and Corinth that the Union Army was unable to pursue based on the gigantic baggage and supply trains that had grown too large to

---

<sup>43</sup>Epstein, *The Creation and Evolution of the Army Corps in the American Civil War*, 33. Additionally, a biography of General Montgomery Meigs' By Russell Wiegley, *Quartermaster General of the Union Army* (New York, NY; Columbia University Press, 1956), addresses this issue of the crisis ad hoc sustainment of forces. The insights Weigley brings to the table on Meigs's problems with contracting are illuminating and in essence no different than today.

<sup>44</sup>Bucholz, 48-50.

<sup>45</sup>Epstein, *Napoleon's Last Victory*, 5. Dr. Epstein was discussing the role of technology in the middle of the 1850s and how they impacted the various levels of warfare.

manage and to effectively move with the armies they were supporting. The role of the railroad had enabled the sustainment of soldiers with ration levels higher than any other army in history but the horse and wagon did not translate to rapid mobility and pursuit logistically.<sup>46</sup>

Even the introduction of the telegraph and the railroad did not break the paradigm of horse and wagon for operational-tactical logistics links. Experience during the Russian Civil War, 1917-1921, would lead Soviet military theorists to challenge this paradigm. The conceptualization of the operational level of war remained challenged by the ability to sustain ones forces especially from the railhead. The concept of deep battle and deep operations put a distinct cast upon industrialization and mechanization. As the Soviet theorists applied the lessons learned from their “war of echelonment” that was fought through the movement of forces in quick order through the Russian rail systems at the operational level they looked to the past for applicable lessons learned.<sup>47</sup> In seeking to understand this problem, the Soviet specialists turned to the American Civil War, as the first example of mass industrial war.

The railroad specifically at the strategic level improved reach, depth, and simultaneity but it could not overcome the lament of Halleck on the immobility of the huge baggage and supply trains that could not move rapidly to support Union armies after victory. The successful use of railroads by the Prussian during their three wars of unification were essential to the initial deployment of forces to the frontiers ready to begin an operation or a series of operations. The railroad played a critical role not only in deployment of forces but also now the mobilization of

---

<sup>46</sup>Herman Hattaway and Archer Jones, *How the North Won; A Military History of the Civil War* (Chicago, IL: University of Illinois Press, 1983), 288. It is interesting to read Halleck’s comments on the growth of the baggage trains and the perception of luxury they implied with the level of rations and personal effects that could be carried by the supply trains.

<sup>47</sup>Triandifillov, *The Nature of the Operations*, 94. General Triandifillov called this the approach march and he and others sought to solve the problem from the railhead through extensive motorization and mechanization to enable quick successive follow on operations.

forces numbering in the hundreds of thousands. The railroad could not overcome the horse and wagon once the forces assembled left the fixed network of the railroads.<sup>48</sup>

## **World War I and the Failure to Operationalize Logistics**

Prior to World War I, there were flashes of strategic logistics that were striking in the distances covered and the amount of forces moved. These movements of vast distances were instances of strategic transportation moving forces to the operational commander. The first was the Great Britain moving a quarter of a million men 6,500 miles from the British Isles to South Africa for the Boer Wars. Russia moved by rail and sea a similar amount to fight the Japanese in the Russo-Japanese War of 1904. The time needed over that great of distance was revolutionary due to the rail and ship technology available.<sup>49</sup> The single railroad line of the trans-Siberian railroad could sustain hundreds of thousands of men over a 5,000-mile supply route.<sup>50</sup> The problem remained of transition from the railhead or port to sustain successive operations.

With the advent of World War I, it is visible the impact of industrialization and transportation infrastructure on warfare and the massive increase in consumption that before the war could not even begin to be imagined. For example, the French underestimated prior to the war the amount of artillery rounds required for the scope of static warfare. The ammunition levels required could not be produced and thus the French operated throughout the war constrained by artillery ammunition production.<sup>51</sup> Essentially the French out consumed their industrial base and

---

<sup>48</sup>Robert M. Citino, *Quest for Decisive Victory: From Stalemate to Blitzkrieg in Europe, 1899-1940* (Lawrence, KS: University Press of Kansas, 2002), 19-20.

<sup>49</sup>Smith, *The Utility of Force*, 73. The British sustained that force over a Sea Line of Communication of 6500 miles during the Boer War of 1899-1902. The Russian did the same with the single line trans-Siberian railroad coupled with the primitive road network where rail lines were yet to be built.

<sup>50</sup>Citino, *Quest for Decisive Victory*, 65-66.

<sup>51</sup>John Mosier, *The Myth of the Great War: How the Germans won the Battles and the How the Americans saved the Allies* (New York, NY: Perennial, 2001), 136-137. The French initially bought the chemicals required for the making of munitions from Germany. Once the war started this supply obviously was taken away. Great Britain and the United States plus internal manufacture were able to make up some



struggled with the logistics demands of the trenches. Just as there was a failure to recognize or understand an intermediate level of war, the same could be said for sustainment of forces in the trenches.

Even with advent of motorization of sustainment elements, the numbers of motor vehicles did not change the dynamics of sustainment. The potential was there but just as there was the dependence on the massive numbers of the horse and wagon, there was also the fixed system of depots, magazines and supply trains existing in massive numbers to support the explosion in consumption. Initial motorization could not overcome the fixed nature of sustainment built up behind the trench system and the massive dependence on the horse and wagon. Rail movement was still much more efficient than the European road network, and as you got closer to the front, you started to deal with the destruction of infrastructure on a massive scale.<sup>52</sup>

The average World War I French infantry division had 3,900 horses, 900 wagons, and a small amount of vehicles. The average Corps contained 15,000 horses and 6,500 wagons. Still any staff officer from the 1800s would have understood how to support the armies in the field.<sup>53</sup> The horse drawn supply columns and the systems of fixed depots and magazines along the lines of communications would be familiar to one Napoleon's or Meigs' quartermaster officers. Munitions and food moved by horse and wagon.

The American Expeditionary Force experience in France was similar to the Napoleonic era of depots arrayed behind the main force on lines of communications to support the static

---

of this difference. Still the consumption rate was staggering and would probably remain constrained regardless of the amount of materials available even in unlimited amounts.

<sup>52</sup>Smith, *The Utility of Force*, 73. Rail movement was much more economical and efficient in the speed it moved men, materials and munitions to the front. This would hold the same in the second world war and would really only change with the advent of inter theater and intra theater air transportation like the C-130, C-141, An-12, An-76, An-120, C-17 and the C-5 transport aircraft.

<sup>53</sup>Triandifillov, *The Nature of the Operations*, 64-65. The analysis of Triandifillov on the post war requirements of transportation without motorization is truly staggering. Triandifillov eventually states that modern arms cannot be supported by the horse and wagon due simply to the numbers employed. Any road network would be overwhelmed and the units would stretch off into the distance without end.

battle or the decisive battle of annihilation. General Carter MacGruder stated, “The U.S. Communications Zone included three echelons of depots: advance, intermediate and base. Stockages at each was based on French experience . . .” and further stated that the “beauty of the system was its simplicity. It worked well in a stabilized theater where the desirable depot stockages had been established by ample experience.”<sup>54</sup> This system would not support a war of maneuver sufficiently because the reach of operational-tactical sustainment was still generally limited to some trucks and still dependent of the horse and wagon.

Imperial German Colonel General Helmuth von Moltke, the German Chief Staff at the beginning of World War I, encountered unseen problems in synchronizing forces at the operational level as the forces got closer to Paris. Since there was not a level of command between the strategic level of von Moltke and the tactical armies moving towards Paris, there was a level of command and control missing that would not be realized until the end of the war. There was not an Army Group that could synchronize between the strategic level and the tactical army commanders such as General Kluck and his First Army. Similarly, without that intermediate level of command and control would also mean that logistics synchronization rested at the Imperial German High Command instead of the Army Group level. The need for an Army Group Headquarters to fill the needed gap between the high command and the army was obvious looking backwards during analysis but not intuitive to the time and concept of art of command with the German General Staff System.<sup>55</sup> The importance of this synchronization of problematic of all armies at the time; the lack of an operational headquarters to reduce the friction of logistics from the railhead to the front trenchline.

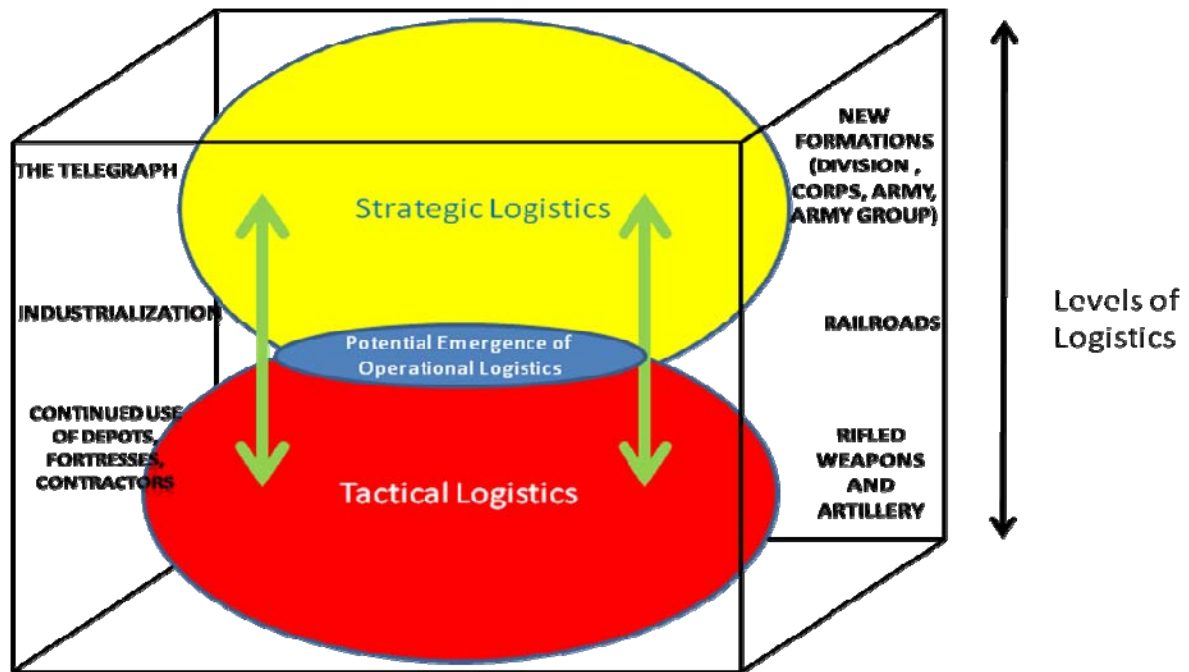
---

<sup>54</sup>Carter B. MacGruder, *Recurring Logistics Problems as I Have Observed Them* (Washington, DC: United States Army Center for Military History, 1991), 3. General MacGruder was a career logistician whose primary experience was World War II but does have observations on World War I mainly to draw contrast to the experience of sustaining forces across the globe during the Second World War onwards.

<sup>55</sup>Barrett. *The Sword-bearers*, 1-98. Similar to the flaw of the lack of headquarters between armies and OHL in the case of the Germans there did not exist similar organizations that could keep up with the new consumption figure of modern artillery and machine gun use.

World War I, when applying the three elements of reach, simultaneity, and depth was as limited as the Napoleonic era. However, there was a potential for operational logistics to emerge whether it was understood or not, the limitations of the horse and wagon coupled with the massive rise in consumption of ammunition of materials would see the ability of sustaining reach, simultaneity and depth as problematic at best.

World War I was a technological break similar to the American Civil War and the railroad and telegraph. Just as Soviet Military theorists that emerged from the Great War and the Russian Civil War realized, the potential for motorization and mechanization of logistics to support the movement and consumption of modern armies was now a real possibility. The implication that the Operational level of war was being realized and that it would have tremendous implications for logistics. The slow transition away from the horse and wagon meant the potential emergence of some aspects of operational logistics. Figure 3 below represents the growth but not emergence of operational logistics.



### Napoleon to the Great War (The Establishment of the Operational Level of War)

Figure 3. From Napoleon to World War I

Source: David S. Alberts, John J. Garstka, Richard E. Hayes, and David T. Signori, *Understanding Information Age Warfare* (Washington, DC: DOD Command and Control Research Program (CCRP), 2001), 108.<sup>56</sup>

<sup>56</sup>This diagram technique demonstrates the forces that are contributing to the beginnings of the operational sphere of logistics. The new formations emerging in the Napoleonic Era and continuing through the Great War range from Division to Army Group. These new formations and their headquarters were not ad hoc units that existed previously but had a set task and purpose with an organizational structure. The new formations coupled with combination of railroads, the telegraph and industrialization truly expanded the reach, depth and simultaneity of war and warfare. The development of rifled weapons and artillery changed the conception of range of consumption of munitions that altered the battlefield math of how materials were required to support an army. Though there was potential for an operational level of logistics to emerge there still continued an adherence to the depot, units trains, sutlers and fortresses to supply armies. There was not a structure to complement the new formations to bridge the gap between strategic and tactical logistics.

## The Interstate Industrial War<sup>57</sup>

The interwar period and World War II represented a transition from decisive battle to recognition that mobilized industrial armies, echeloned in depth operating in multiple theaters, represented a new paradigm that was not understood in World War I. The post Napoleonic realities of World War I and the exponential effects that the development of firepower, generating force structure, and transportation infrastructure had on expanding a series of campaigns, operational areas, and ultimately the operational level of war to a level previously unseen.<sup>58</sup> The fundamental issue was how to transition from positional warfare to maneuver warfare and regain the implied decisiveness of maneuver warfare.

The scale of warfare that was seen from 1914 to 1918 could, and would, be exceeded as industrial economies produced on an immense scale. The result would mean a fully mechanized and motorized force that truly departed from the horse and wagon. The challenge would not only be producing the material needed for the armies but sustaining them while they were conducting operations. The operational level of war was emerging but there were true hurdles to providing logistics support to operational forces conducting successive operations with mechanized units over vast distances.<sup>59</sup>

As armies experimented with varying successes in mechanization and the integration of the tank, unit's consumption estimates for sustainment continually increased. The Soviet theorists

---

<sup>57</sup>Smith, *The Utility of Force*, 31. The phrase "Interstate Industrial War" is coined by Rupert Smith as he described the period of warfare between Napoleon and the first use of the atomic bomb. The use of this term is great context for this chapter as it covers the period of post Great War to the detonation of the atomic bomb. Massive Industrialization was taking place in the new Soviet Union and the period of warfare that would be seen in World War II was truly Interstate Industrial War. There were constants of the rail networks of Europe and the infrastructure of roads stretching from France to Poland and the explosion of mass produced shipping on Sea Line of Communications to sustain ground armies in the various theaters of war

<sup>58</sup>Mosier, *The Myth of the Great War*.

<sup>59</sup>Van Creveld. *Supplying War*, 150-151. Van Creveld in analyzing Operation Barbarossa discusses the problems with transport, repair parts, and infrastructure required for extensive operations in the preparations for the defeat of the Soviet Union. Van Creveld's point tie in with Tukhachevsky's and Svechin's precepts on sustaining operational armies enabled to conduct simultaneous and independent successive operations.

were not only writing about the consumption of units but also theorizing on the militarization of society and the importance of the industrial base of a nation sustaining a force of quantity and quality.<sup>60</sup> A militarized nation, with an integrated transportation network with industry supporting the material and technological needs of the nation's forces, would be terribly lethal.

The Soviet Union in their path of massive industrialization and collectivization of their economy understood the amount of material required to support such a force. By the mid 1930s, the Soviets had fully mechanized four corps to support the emerging doctrine of Marshal Tukhachevsky and others of Shock Armies, Deep Battle and successive operations embodied in the Red Army's 1936 Field Regulations.<sup>61</sup>

Even in the early thirties, the material required to support a partially mechanized Soviet Corps was estimated to be 30 trainloads of supplies per day in limited penetration operations.<sup>62</sup> Logistically, the horse and wagon could no longer adequately sustain the new formations integrating technology like the tank. Until operational logistics could support multiple concurrent and successive echeloned operations with the proper sustainment reach, simultaneity a depth there would be a serious impediment to the success of operations. From the Soviet Civil War to the end of World War II, operational logistics would struggle to bridge the gaps in capability needed to sustain the operational commander.

---

<sup>60</sup>Svechin, 169-179.

<sup>61</sup>Citino, *Quest for Decisive Victory*, 211. The four fully mechanized corps of 1936 were later dismantled in the aftermath of Stalin's purges of the 1938 and parceled out to the rest of the Red Army. Reorganization back to the fully mechanized formations envisioned by Tukhachevsky would not be realized until late 1943 and fully employed until summer of 1944 with Operation Bagration and the destruction of the Wehrmacht's Army Group Center. The material excellence of the Soviets meant fully mobile and motorized formations driving westward towards Germany.

<sup>62</sup>Triandifillov, *The Nature of the Operations*, 126-127. It was not only 30 trainloads but also around 30 rail cars per train. General Triandifillov continually emphasizes the importance of movement of materials from the railhead to the operational force and the reality that each formation would be responsible for its own transportation and sustainment of its own forces.

## The Polish Campaign of 1920 – Emergence of Operational Art and the Failure of Operational Sustainment

The Soviet--Polish War of 1920 was a great example of the disconnect between the emerging operational level of war and the sustainment of operational forces. The distances covered combined with the use of rail make this campaign unique and a first and must be considered a departure point different from World War I.<sup>63</sup> The importance of this campaign and the Soviet Theorists who emerged from this period was critical to the development of the operational level of war. The revolutionaries and the *Voenspetsy* of the former Czar's army intellectually capitalized on the lessons from the civil war, World War I, and the military study of post Napoleonic history. Subsequently logistics and the conceptualization of the material required to support mobile, fully mechanized warfare, though theorized would remain to be many, many years away from realization.<sup>64</sup>

The Soviet-Polish War was an outgrowth of the expansion of the new Polish state into the Ukraine westward and the Soviet's attempt to stabilize borders to pre-1914 Tsarist territorial boundaries. The Soviets were driven out of the western Ukraine and were unable to take any action until the Civil War against the White Russian forces turned in their favor. Tukhachevsky had assembled five Red Armies totaling 160,000 soldiers in a short period of time in what the Soviets called at that time "echelon war" which is the shuttling of sparse Red Forces between

---

<sup>63</sup>Jacob W. Kipp, *Mass, Mobility And the Red Army's Road to Operational Art 191-1936* (Fort Leavenworth, KS: Foreign Military Studies Office, 1988), 5-6. There will be continued use of the concepts of the Soviet military theorist from the interwar period. The gestation of the operational level of war and codify the lessons learned from the Napoleonic period forward captured the departure from the great battle of annihilation to one of attrition and exhaustion that must be addressed operational level commanders conducting successive operations in multiple theaters sometimes independently. These new young leaders were quick to study and learn and could internalize lessons from the defeat of the German Army in the west to their own struggles against the White Army and the Poles. Additionally the revolution brought a methodical and scientific rigor to the Soviet study of warfare that produced operational theory, supported by an industrialized nation-state, which could transition from positional to decisive maneuver warfare.

<sup>64</sup>The term *Voenspetsy* refers to the military specialists that have been employed in the service of the Russian and subsequently the Soviets. During the Russian Civil War from 1917-1921, *Voenspetsy* referred to Russian officers formerly part of the Czar's armies. There was tremendous friction with the employment of the military specialist and many Soviet leaders would never trust the *Voenspetsy*. Stalin is a great example of the embodiment of distrust.

threatened fronts whether against the White Russians or the Poles.<sup>65</sup> This shuttling of forces utilized the existing interior railroad network to its fullest. Planned operations were to be mobile based on cavalry lead armies on the flanks of the Russian forces but started with focused frontal blows on the Poles left flank abutting Lithuania.<sup>66</sup>

The Red Campaign began on 5 July and quickly caught the Poles overextended, under-supplied, and conducting a forward linear defense. The frontal strike on the Poles left flank by the beginnings of a Shock Army embodied by the cavalry armies of Tukhachevsky to begin a war of maneuver, which quickly gained back all territorial losses incurred to the Poles. Tukhachevsky conducted a series of operations that eventually led the five Red Armies to the outskirts of Polish cities of Warsaw, and Lvov to the south. Defeat seemed imminent for the Polish Government. Yet like the Poles earlier, the Reds were overextended, undersupplied, attrited, and rent with dissension. They were ripe for a counter-offensive, which did land and set in motion a chain of Red defeats that ended the war with the Treaty of Riga.

The Polish-Soviet War was the operational warfare attempted by the Red Army. Though severely under-resourced and the application of the industrial might of the Soviet Union many years away conceptually, it was an attempt to conduct the application of shock units to enable maneuver warfare. Most importantly was the concept of successive operations carried through to the gates of Warsaw. Lastly was the role of the transportation networks that enabled the quick gathering of Red Armies to mount the campaign. Still Svechin sums up the operational logistics preparations by stating, "Rational organization of logistics requires at least the approximate determination of certain standards pertaining to time, space and intensity that defines the lines of

---

<sup>65</sup>Kipp, *Mass, Mobility And the Red Army's Road to Operational Art 191-1936*, 1-22. The key to echelon war was the how the movement by rail enabled economy of force operations, and a departure from static positional warfare. The Soviet Interwar Theorists all struggled with the issue of movement of men, equipment and materials from the railhead. The solution was the total mechanization and motorization of all arms both combat and supporting forces to include logistics. Triandifillov's quote, One must be fully aware both of contemporary achievements in military equipment and trends in the further development of every type of weapon. Otherwise, one cannot understand those changes that may occur in the organization of armies in the near future," is relevant to this issue.

<sup>66</sup>Triandifillov, *The Nature of the Operations*, 115.



communication needed, supplies and communications, evacuation of the wounded that administration of occupied territories and so forth.” He ends discussing the plan of operations by stating that, “seas of ink were not spilled in planning . . . the July offensive of the Western front in 1920. Our reaction to the carelessness of preparations and logistics that characterized the Red Army’s Warsaw operation should not impel us to the opposite extreme.”<sup>67</sup>

Though critical of themselves, the logistics of the successive operations that brought the Red Army to the gates of Warsaw could not keep up with the depth of operations, the reach of forces, and the simultaneity of sustainment needed to support the five armies assembled by Tukhachevsky. The breakdown of sustainment was essentially Napoleonic. The horse and wagon limited the speed of sustainment as each of the five armies moved away from the railheads.

### **“What Could be” – Operation Barbarossa**

The campaign plan for Operation Barbarossa was a campaign plan designed for a totally mechanized force.<sup>68</sup> The verbiage of the German High Command’s Directive 21 for Barbarossa was of, “daring operations spearheaded by armored thrusts,” and “fast pursuit” of enemy forces.<sup>69</sup> Amassed to support this operation would be three million men, 600,000 motor vehicles and 3,350 tanks and even a greater number of men vehicles and tanks faced them arrayed in echelon against them by the Red Army.<sup>70</sup>

---

<sup>67</sup>Svechin, 278.

<sup>68</sup>Van Creveld, *Supplying War*, 142-180. Mr. Van Creveld makes this point a few times during the chapter “Russian Roulette” as he breaks down the logistics inefficiencies of the German Army and the attempts made to overcome the deficiencies affecting operations.

<sup>69</sup>Department of the Army, Pamphlet No. 20-261a, *The German Campaign in Russia; Planning and Operations 1940-1942* (Washington, DC: Department of the Army, 1955), 22. Also an area to highlight in Directive 22 is the focus on the seizure of Leningrad and the Baltic states with heavily motorized and armored formations.

<sup>70</sup>Trevor N. Dupuy, *A Genius For War; The German Army and General Staff, 1807-1945* (Englewood Cliffs, NJ: Prentice Hall Inc., 1977), 269. The Russian numbers were truly phenomenal but the numbers were diffused and unfocused as a result of the late 1930s purges of the Red Army leadership. Armor was not as concentrated as envisioned by PU-36, the Red Army’s Field Regulations as laid out by Tukhachevsky. The numbers would not be revealed until the tallies from the great cauldron battles of 1941

Perception of the Wehrmacht at the time with 600,000 vehicles was that it was a motorized army. It was ironic that during Operation Barbarossa, and continuing throughout the war, that the Wehrmacht was as an institution that was terribly dependent on the marching infantryman and the horses to move artillery. Additionally the supporting rear service troops and their minimal truck fleets were unable to sustain the Germany Army in combat. In fact during the preparations for Operation Barbarossa, 75 Infantry divisions were issued the eastern European ‘panje’ wagon to mitigate motorized transport shortages.<sup>71</sup> For Operation Barbarossa, the Germans used 625,000 horses compared to the 725,000 horses used at the beginning of the drive on France in 1914.<sup>72</sup> What would compound the sustainment problems of this semi-motorized conglomeration was the movement away from the railroad and the lacking road network to facilitate the sustainment of the partially motorized formations. Operation Barbarossa was design for a fully motorized and mechanized Wehrmacht.

Mobile mechanized operations represent a departure from past types of warfare regarding primary mode of transportation. With mobile warfare, there is a transition in importance of the railroad versus the road. Though dependent on the railhead for the movement of troops, equipment and supplies, the dependence of motorized formations on road networks becomes vastly more important with the fluidity of operations. The importance of the road network is essential when conducting multi front independent but supporting operations. The railroad could not support mobile operations adequately.<sup>73</sup> The implied task from this realization is the

---

and the dawning realization for the Germans though hundreds of formation and their equipment had been destroyed, the Red Army had hundreds more in forming echelons meeting the Wehrmacht’s advance.

<sup>71</sup>Van Creveld, *Supplying War*, 151.

<sup>72</sup>Depuy, 269.

<sup>73</sup>Van Creveld, *Supplying War*, 143. For the German Army to replace one train double track rail line equivalent over 1600 equivalent trucks are needed. This trend moving away from the railroad to the road network continues today with the airfield and the ability to sustain out of an airhead. The Germans and to some extent the United States and Great Britain utilized aircraft and the sustainment of formations through Airfields and parachute supply drops. The Germans were forced to do this in an attempted large scale at Stalingrad and later Cherkassy. The United States Army Air Corps did limited supply drops in support of airborne operations and encircled forces like Bastogne.

motorization of supply and rear area troops to enable supply of the tank and supporting formations moving swiftly forward.

Though the German fought Barbarossa like they were motorized both in the plan they executed and the operations attempted, their experience on the Eastern Front would be one of half measures as in the end they were unable to motorize fully their divisions through either lack of industrial capacity or other production priorities. As the war in the east ground on the Wehrmacht was faced with an increasingly motorized Red Army, who by late 1943, and certainly by summer 1944 was truly a mobile and fully motorized foe.<sup>74</sup>

Still the army that took the right approach, left the horse behind, and threw weight of her industries behind lend lease to her allies and her armed forces was the United States. The United States Army entering the European Theater of Operation (ETO) on June 6, 1944 was fighting as a truly 100 percent mechanized force. Horse drawn artillery and logistics had left the battlefield for the American Army.<sup>75</sup>

### **The 90 Division Army and Today's Army**

A striking feature of World War II was America's ability to raise and equip a modern army seemingly overnight.<sup>76</sup> Current operational sustainment trends are firmly rooted in the force structure and thought processes of the 90 division "Victory Plan" Army laid out in 1941.

Brigadier General Albert Wedemeyer and his War Department War Plans Division team putting

---

<sup>74</sup>The Soviets in 1944 were equipped with predominately motor transport that was from Lend Lease program. GMC Trucks, jeeps and other makes of vehicles were all though the Red Army formations. The Soviets still had mounted troops on horseback but that was not for a lack of vehicles but a conscious choice to have cavalry formations for battlefield uses.

<sup>75</sup>Charles E. Kirkpatrick, *An Unknown Future and Doubtful Present: Writing the Victory Plan of 1941* (Washington, DC: Center for Military History United States Army, 1992), 81. Charles Kirkpatrick notes that General George C. Marshall realizes that the mass of lend lease equipment destined to head to Russia and Great Britain was not sufficient to turn the tide of war and a significant United States Army would be needed. BG Albert Wedemeyer based on Marshall's guidance developed the 90 division Victory Army and even more important the framework for the Army Air Corps and the total manpower figures that the United States would have available for mobilization; between 10-14 million men.

<sup>76</sup>*Ibid.*, v contained in the forward authored by COL Harold W. Nelson, USA

together the 1941 Victory Plan recognized early that there was a need for an enormous number of vehicles to supply the forward elements of a mobile army. The decision was made to make the logistics units as mobile as the combat units mainly to both keep up and sustain massive increases in firepower and consumption of the weapon systems built into the regiments and divisions of the Victory Army.<sup>77</sup>

Still full motorization was not the panacea in closing the distance between the railhead, beachhead and port. The breakout of from Normandy and the race to the German borders by Patton's 3rd Army speak volumes to the lessons still to be learned in coordinating the new, mobile, and massive logistics infrastructure operating on the battlefield. The lack of operational level C2 attempting to sustain different army groups and armies with different missions and timing was a severe constraint.<sup>78</sup> There was a gap in C2 that existed between the combat units, the Army Service Forces (ASF) and Communications Zone (COMZ). The C2 of the individual quartermaster, supply and transportation units sustaining the drive to the Reich was lacking.

The logistics forecasts of the ASF were always more pessimistic than reality would present and the ASF demonstrated time and time again that the logistics structure supporting the ETO was prepared to sustain the fight similar to the last war, France 1918.<sup>79</sup> The issues that quickly faced a fully motorized force was not only how do you support the combat forces but also how do you organize C2 headquarters and support relationships?

---

<sup>77</sup>Kirkpatrick, 88-89. The implied in Crevel'd's writing is there is a blank whole in the sustainment architecture to command and control the sustainment effort of not only Patton's 3<sup>rd</sup> Army but also all allied forces in general.

<sup>78</sup>Van Crevel'd, *Supplying War*, 202-230. The amount of supply and transportation was adequate and in some cases more than the requirement to sustain allied armies in France driving eastward. Sustainment of Allied Armies became a question of scope and the ability to support disparate efforts across the battlefield. The Army Service Forces in the Communication Zone (COMZ) that was building was focused on building the life support infrastructure needed and was a trend that continued from the Great War. The life support mission can be seen in the tooth to tail ratios that began to develop and grow from the World War One onwards. The link between the combat armies pushing forward in Europe and the COMZ and its vast stockpiles was one of requestor not the push/pull system of sustainment we are familiar with. The armies and Army Groups were equals to the COMZ in the C2 architecture of ETO.

<sup>79</sup>Van Crevel'd, *Supplying War*, 212-213.

The interwar period, through 1944, represented a true leap in the sustainment of forces at the operational level for those understanding the implications of full motorization and the vast quantities of material required to support motorization. Operational Logistics began to emerge but there were still limitations imposed of sustaining fully motorized formations. These limitations focused on the command and control of synchronized logistics support. The ability to sustain echeloned independent forces conducting successive operations was somewhat realized by 1944 for both the Americans in the ETO and the Soviets in the East, though both armies were essentially fully mechanized. Tukhachevsky addresses the challenges of mechanization, which “opened a way to a whole new approach to planning of procurement, force structure, tactics and training.”<sup>80</sup>

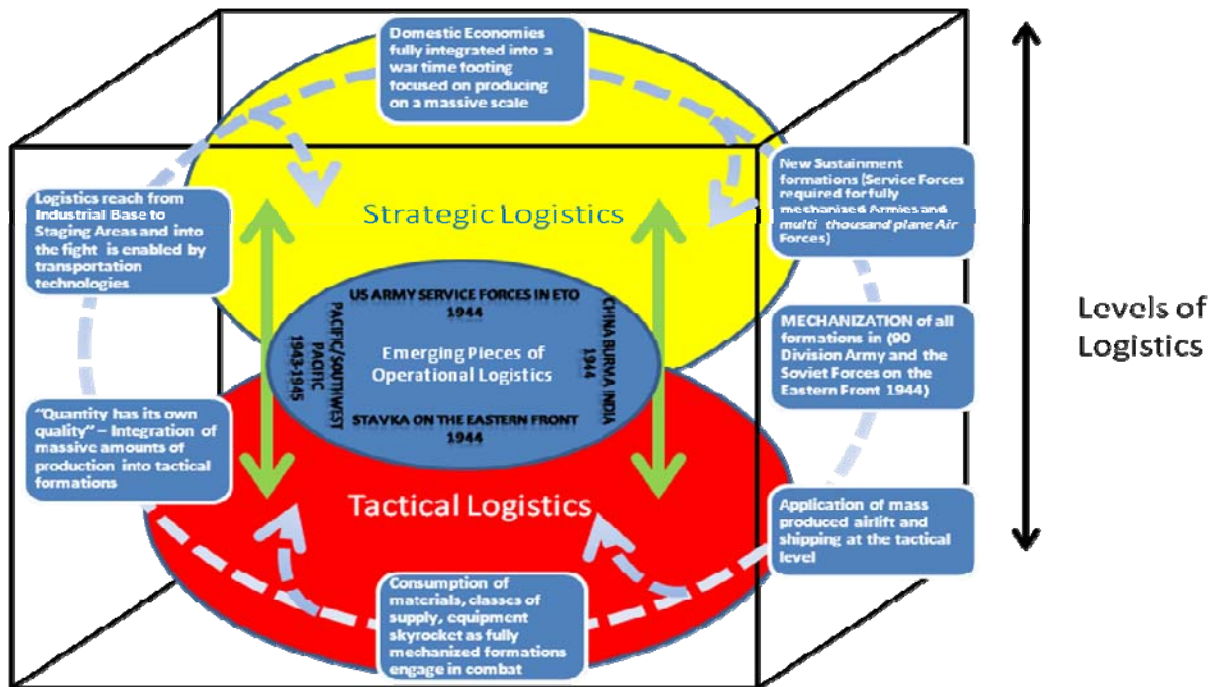
Finally the motorization of support arms significantly increased the operational forces’ reach and begins to break the chains of the Napoleonic system of rigid depots, magazines and the trusty division and corps trains following along the route of march. Additionally the sustainment of multiple operations with simultaneity and depth starts to develop and become possible as the paradigm of becoming less effective as the distance grows between the armies supported and the railhead is mitigated by motorization (see figure 4).

With the closing of General Smith’s Interstate Industrial War, the farewell of the horse and wagon as the linchpin of sustainment was complete and “the rise of the gasoline powered motor vehicle meant that armies were now released from the tyranny exercised over them by railways since the days of Moltke and Grant.”<sup>81</sup>

---

<sup>80</sup>Richard E Simpkin, *Deep Battle: the Brainchild of Marshall Tukhachevsky* (London, England: Brassey’s, 1987), 136.

<sup>81</sup>Martin Van Creveld, *Command In War* (Cambridge, MA: Harvard University Press, 1985), 190.



## Interstate Industrial War (The Beginning Emergence of the Operational Level of Logistics)

Figure 4. 1918 to 1944

Source: David S. Alberts, John J. Garstka, Richard E. Hayes, and David T. Signori, *Understanding Information Age Warfare* (Washington, DC: DOD Command and Control Research Program (CCRP), 2001), 108.<sup>82</sup>

<sup>82</sup>This diagram technique demonstrates the forces that are contributing to the expansion of the operational sphere of logistics. The mechanization of warfare continues and contributes to an explosion of consumption of materials to include, fuels, munitions and spare parts. Even more critical is the war based economy that is capable to produce the material like trucks, tanks, self propelled artillery, support equipment and all the other major pieces of equipment necessary for the fully motorized and mechanized warfare. Transportation technologies continue to speed the movement of materials from the industrial base to the railhead, port or beach. Motorization begins to solve the movement of materials from the railhead, port and beach to the forward elements of the mechanized formations conducting successive operations. The Allies in the ETO, the Russians in 1944, China, Burma, India Theater of Operations and The dual drive in the Pacific Theater of Operations show the potential and the beginnings of the emergence of operational logistics supporting the operational commander and his forces. The issue that remains unsolved is the appropriate structures and theory to now C2 and sustain a mechanized army. Full motorization of support forces to provide logistics from the point of entry through a road network was a revolutionary leap from the horse and wagon and the Napoleonic system of logistics (maybe even Frederick the Great's system of sustainment).

## Deterrence and Air-Land Battle

The use of nuclear weapons at the end of World War II, becomes a breakwater point in operational logistics. The nuclear era of deterrence represents stagnation and demonstrates the effect of the tactical tripwire of strategic nuclear weapons on force structure and equipping. Still, all the tools for operational logistics exist for emergence but remain suppressed. Long range heavy lift aircraft, integration of computers and data processing into sustainment, and appropriate C2 headquarters empowered operational commanders. In the age of deterrence and the tripwire of active defense, the conflict in Vietnam provides a glimpse of emerging operational logistics.<sup>83</sup>

Wheeled and tracked vehicles were now standard in formations. The largesse of the World War II industrial effort continued to be seen in Korea in 1950, in the equipping the French Army in Vietnam in the mid-1950s, and in the U.S. Army formation awaiting slow modernization throughout the 1950s.<sup>84</sup> Each non-nuclear conflict brought out improvisation of logistics forward of the railhead, port and now airhead. The United States Army in the Korea War used human porters with A-frames in the most difficult terrain and the French flew in M-24 Chaffee Tanks piece by piece to give an armor presence at Dien Bien Phu.<sup>85</sup> The logistics model continued to look and feel like World War II.

---

<sup>83</sup>Graham A. Cosmas, *MACV; The Joint Command in the Years of Withdrawal 1968-1973* (Washington, DC: The U.S. Army Center of Military History, 2007), 6. Military Assistance Command Vietnam (MACV) was a subordinate-unified command that integrated computer, data processing and the 1st Logistics Command providing common supply needs to all components. Private Military Companies like Kellogg Brown and Root were contracted to build the base and airfield infrastructure and provide services to MACV units.

<sup>84</sup>Julian Thompson, *The Lifeblood of War: Logistics in Armed Conflict* (London, UK: Brassey's, 1991), 124-173. The American equipping of the French formations during their conflict with the Viet Minh reads like an equipment who's who from World War II. The equipment included B-26 Bombers, C-47 Transports and F-6 Bearcat Fighters as just a few of the surplus nomenclatures given to the French.

<sup>85</sup>Bernard Fall, *Hell in a Very Small Place* (New York, NY: Vintage Books, 1968), 96-97. The French flew in 10 ea M-24 tanks and reassembled them in a jungle environment. Aircraft used were the C-47 and the Bristol front Clamshell transport.

## The Deterrence Era and Operational Logistics

The emergence of nuclear weapons and the new direction of the “New Look” defense strategy of President Dwight Eisenhower integrated nuclear weapons all the way to the tactical level.<sup>86</sup> The Soviet Union under Nikita Khrushchev undertook similar nuclearization of all things tactical. Development, procurement, and fielding of nuclear weapons and the support equipment took precedence over a robust equipping of conventional forces. The United States Army, in the 1950s and early 1960s, remained focused on its missile programs. Tactical nuclear missiles became the ultimate artillery. The mindset of the ground forces at the time was one of area defense.<sup>87</sup> Compounding the nuclearization of the services was a constrained budgetary environment. The battle for a place at the budget table for limited procurement dollars left minimal monies available for conventional forces. This tension of limited monies and marketability of nuclear forces essentially left bereft, the services, especially the army, ideas for the employment and sustainment of forces above the tactical level.

The emergence of civilian strategists, Herman Kahn and Bernard Brodie, brought a new factor to the table of warfare. The influence of their written works and meant civilians were taking the lead on U.S. Strategy formulation. The emphasis of the strategic model of deterrence, and winning with nuclear weapons was paramount. The “Defensive Mentality” eschewed by Kahn would now be an official part of policy and reinforce the nuclear tripwire at the tactical level.<sup>88</sup> Technological advancements in computers, heavy airlift, fast sea transportation, and C4

---

<sup>86</sup>Dale R. Herspring, *The Pentagon and the Presidency; Civil Military Relations From FDR to George W. Bush* (Lawrence, KS: University Press of Kansas, 2005), 85-117. The New Look strategy committed the United States to a nuclear centric posture that would serve the nation until the late 1970s and early 1980s. The significance is the focus on nuclear weapons at the tactical level upwards that were counted on to reduce the numerical and later potential equipment superiority of the Soviet Warsaw Pact forces

<sup>87</sup>Andrew J. Bacevich, *The Pentomic Era* (Washington, DC: National Defense University Press, 1986), 115. The US Army at the time was struggling for missions and identity. The Pentomic Division came into being to address the need for the soldier to fight and win on the atomic battlefield.

<sup>88</sup>Herman Kahn, *On Thermonuclear War* (Princeton, NJ: Princeton University Press, 1961), 470-471. The focus of Herman Kahn was the quality and quantity of nuclear weapons to win and that all things military were subordinated to the strategic level.



would focus at the strategic level. The industrial militarized state would serve as the vast pool of resources pushing materials downward, focused on fighting and winning a decisive nuclear war and surviving.

Vietnam would provide a glimpse of operational logistics as limited war emerged in spite of the deterrence era. The expanded role of intra and inter theater lift; contracted infrastructure and sustainment; and improved C4 Logistics were all at work in Vietnam.<sup>89</sup> However, in the era of deterrence there was not an expeditionary or dedicated C2 logistics structure prepared to deploy to support a unified command or subordinate unified command. Logistics would remain ad hoc operationally and tailored painfully to support units in combat.<sup>90</sup>

### **Everything is Strategic**

By the mid 1950s, U.S Army Officers believed they could decide the outcome of the next war by using tactical nuclear weapons.<sup>91</sup> The design and employment of the Pentomic Battle Groups and fielding of tactical nuclear weapon systems like the Davey Crockett, Little John, and the Honest John Missiles pushed tactical nuclear weapons into the hands of the soldier on the ground. Conventional equipment design and fielding continued at a much slower pace and were evolutionary improvement of designs from World War II. Fielding of equipment not related to the nuclear rocket or associated nuclearization of forces was definitely a secondary priority for the Army.<sup>92</sup>

---

<sup>89</sup>Thompson, 195. Thompson comments on the exponential capability increase of capability with rotary and fixed wing aircraft like the C-7 Caribou; C-123 Provider and the C-130 Hercules. Intra theater airlift is defined as Airlift conducted within a theater and Inter theater lift is defined as common-user airlift linking theaters to the continental United States and to other theaters as well as the airlift within the continental United State and also formerly known as strategic airlift.

<sup>90</sup>Jerome G. Peppers, *History of United States Military Logistics; 1935-1985* (Huntsville, AL: Logistics Education Foundation Publishing, 1988), 223.

<sup>91</sup>Bacevich. *The Pentomic Era*, 54. There was an identity crisis in the Army and the officer corps in general embraced the tactical use of nuclear weapons for relevancy and professional duty. Bacevich termed problem as a corporation facing extinction if it did not modernize immediately for relevancy.

<sup>92</sup>*Ibid.*, 99-101.

This focus would continue through 1976 with the publishing of the United States Army Field Manual (FM) 100-5, *Operations*, focused on the concept of Active Defense. Active Defense would match the technological edge of the United States against the echeloned Warsaw Pact forces facing NATO in Europe. Tactical field forces served as a hard edge of resistance employing lessons learned from the Yom Kippur war of 1973. In the end, Active Defense fails at addressing the continued echelonment of the Warsaw Pact Forces facing NATO in Central Europe.<sup>93</sup> Escalation to nuclear weapons was not if, but when.

Still, more importantly this FM started the sea of change intellectually in the defense community and the United States Army as it sought to address the declining professionalism of the officer cadre and realized post-Vietnam educational issues. As one civilian analyst stated, “we are still practicing Grant’s attrition warfare.”<sup>94</sup> Additionally the sustainment models were a continuation of the 1940s, 1950s, and 1960s of the strategic level of sustainment pushing down the massive amounts of materials needed to fight a massive clash of arms on the central plains of Europe. The depots and the industrial base existed to continue to support the top down focus of logistics.

#### **C4 Centralization**

The close of World War II introduced the computer as a command, control, and information weapon on the battlefield. Van Creveld comments that, “after 1945, several factors came together and caused the American armed forces to undergo an unprecedented process of centralization. In the first place there was a revolutionary explosion of electronic communications and automatic data processing equipment which made effective worldwide command and control

---

<sup>93</sup>Shimon Naveh, *In Pursuit of Military Excellence, The Evolution of Operational Theory* (London, UK: The Frank Cass Publishers, 1997), 253.

<sup>94</sup> Ibid., 256. Naveh addresses the role of the civilian thinker and analyst holding the defense institution and the United States Army in particular

form Washington a practical technological proposition.”<sup>95</sup> Feeding the emerging electronic explosion into the emergence of the “New Look” defense strategy, communications architecture was strategically centralized. The flattening of the sustainment model enabled by C4 remained unrealized. The importance of this centralization revolved around the fail-safe centralization of controlling the deployment and use of nuclear weapons.

There were glimmers of decentralization of logistics C4 in Vietnam. The requirements of the conflict demanded infrastructure, communications architecture, road networks, and airfields be established to support the forces operationally. Ad hoc logistics headquarters became necessary to support the hundreds of thousands of troops and their equipment engaged in continuous operations. The new C4 technologies of such as the mainframe computers, AUTODIN, and AUTOVON digital data and voice communications tools become tools of the operational logistician in Vietnam.<sup>96</sup>

### **Air land battle and DOTMLPF**

The publishing of the U.S. Army’s 1982 FM 100-5 represents the beginnings of the emergence of operational level of logistics seen today. The doctrine introduced focused on defeating the numerous echelons of the Soviets without resorting to nuclear weapons. The confluence of continued mechanization (i.e. procurement of the “Big 5”), heavy lift aircraft, and C4 improvements, paved the way for structural changes in composition of forces and the institutional army.<sup>97</sup> This combination of Doctrine, Organization, Training, Material, Leadership,

---

<sup>95</sup>Van Creveld, *Command in War*, 236-237.

<sup>96</sup>Peppers, 246-253. The introduction of the digital transmission technologies such as AUTODIN and AUTOVON though being used for by the operational commander in Vietnam were technologies for Nuclear Warfare C2. AUTOVON is short for Automatic Voice Network, was an American military phone system built in 1963 to survive nuclear attacks. AUTODIN is short for Automatic Digital Network and is a worldwide-computerized communications system developed in the mid 1960s.

<sup>97</sup>Citino, 261-267. DOTMLPF is an acronym for Doctrine, Organization, Training, Material, Leadership, Personnel, and Facilities. The publishing of FM 100-5 was a roadmap for equipment purchases; establishment of a doctrinal base, which would serve as leadership and training impetuous; an agent of organizational change; and the establishment of training facilities like training centers that were a departure from training models currently being used. Additionally “the Big 5” in equipment for the United

Personnel, and facilities (DOTMLPF) begins to create the forces that will enable an operational commander to fight and sustain his forces for successive echeloned operations over an extended period.

One must be mindful that the Soviet Union was undergoing a similar intellectual and structural revolution. The U.S. was reacting to their multiple echelons prepared for self-contained operations of penetration, shock, and maneuver. Soviet General Makhmut Gareev led the intellectual rediscovery of deep battle and the development of the Operational Maneuver Groups (OMG) and deep air-mechanized operations. What was essential to the Soviet intellectual awakening was the rehabilitation of the operational thinkers of the early Red Army; Tukhachevsky, Svechin, Triandifillov, and M.V. Frunze. This led to similar structural, equipping, and intellectual changes that were presenting conventional, non-nuclear options in Central Europe and elsewhere.<sup>98</sup> Their demonstration of their new formations called Operational Maneuver Groups in “Zapad 81” was a bowshot to NATO and specifically the United States Army in the challenges to expect in executing Air-Land Battle.<sup>99</sup>

Though simplifying the events leading to the publishing of the FM 100-5, the intellectual revival of the United States Army and the recognition of the operational level of war started a chain of events that that lead us to the combatant commands seen today. Once deterrence collapsed, conventional alternatives were needed to prevent the immediate escalation from

---

States Army to fight Air Land Battle, which was the M1 Abrams Tank, M2 Bradley Fighting Vehicle, AH64 Apache Attack Helicopter, UH60 Blackhawk Utility Helicopter, and the Patriot Air Defense System. The sustainment structure to support these systems for spare parts, bulk fuel and munitions would create a similar equipping effort in the support forces of computer automation, echelonment of C2 headquarters and formation for sustainment of the Air Land Battle Army.

<sup>98</sup>Jacob W. Kipp, “Confronting the RMA is Russia,” *Military Review* (May/June 1997): 49-56. The United States Army’s intellectual journey was a response to many stimulus to include the Arab-Israeli 1973 War, the lessons learned from Vietnam and the reaction to the failure of Active Defense to defeat the multiple echeloned Soviet Threat. Our Air Land Battle doctrine is a reaction to the OMG and the deep echelonment of the Soviet Army.

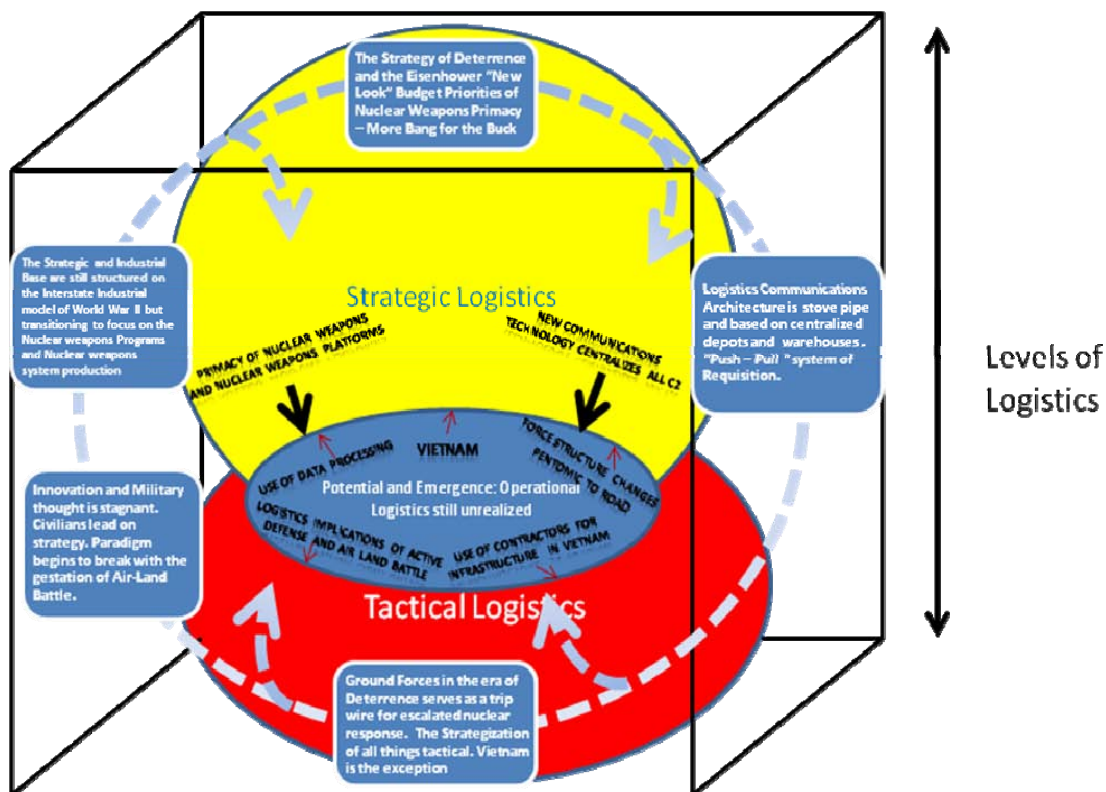
<sup>99</sup>Citino, 260-262. Though the exercise “Zapad 81” was small in scale it still was a demonstration of concept of what the average U.S. Division could expect to face them in an echeloned fight. The Soviets had a similar Big 5 consisting of the T-64/T-72 Tanks, BMP 1 and 2 Infantry Fighting Vehicles and Attack and Lift Helicopters.

tactical combat to the use of strategic nuclear weapons. Subsequently, an explosion in the development of the operational level of war and subsequently the operational level of sustainment begins.

Enabling this explosion is the exponential growth of information technologies, processor technologies, precision guided weapons, and transportation systems. In the western professionalized militaries, there is an expansion of depth in the operational level of war not only on the battlefield but cognitively as well. The operational level of logistics begins its emergence as an operational commander sees massive growth in the reach of sustainment, and sustainment's ability to simultaneously support forces in depth (see figure 5). True emergence for operational logistics in the U.S. Army would begin to take place after the enactment of the 1986 Goldwater-Nichols Act. The Goldwater-Nichols act begins to empower the combatant commanders.<sup>100</sup>

---

<sup>100</sup>Herspring, 291-296. The Goldwater Nichols Act of 1986 was an attempt to make for efficient the Department of Defense by forcing an end to the inter-service rivalries that were stove piping the services. Streamlining of the military chain of command and the empowerment of the combatant commanders were critical parts of the Goldwater-Nichols Act.



## Deterrence and Air Land Battle (1945 to late 1980s)

Figure 5. Operational Logistics 1950 to 1986

Source: David S. Alberts, John J. Garstka, Richard E. Hayes, and David T. Signori, *Understanding Information Age Warfare* (Washington, DC: DOD Command and Control Research Program (CCRP), 2001), 108.<sup>101</sup>

## Kuwait to Iraq

Their achievements are especially spectacular in the light of the fact that we supported a 21st century battlefield with a mid-20<sup>th</sup> Century logistics structure.<sup>102</sup>

– LTG Claude V. Christianson

<sup>101</sup>This diagram technique demonstrates the forces that are contributing to first the suppression of the operational level of logistics in the nuclear era of deterrence, and the beginning of emergence in the late 1970s and early 1980s. The institution of the “New Look” Defense Strategy placed the United States Army and the other services into a search for relevancy and missions in the nuclearization of all things on the battlefield. Emerging Communications technology served as a strategic centralization of command and control. The diagram shows the potential Vietnam exhibited in the sustainment of forces that involved PMCs; computers and automated data processing.

<sup>102</sup>LTG Claude V. Christianson, U.S. Army DCS G4, Testimony before the House Armed Services Committee, March 30, 2004. General Christianson’s testimony was post Operation Iraqi Freedom One and contained a good deal of criticism and praise for the logistical effort that sustained the Ground Component Drive on Baghdad and the fall of the Saddam Hussein Regime.

Operations Desert Shield and Desert Storm demonstrates the emergence of operational logistics. The conflict represents the close on the ghostly remnants of the mass industrial model of World War II and a cognitive transition to a leaner sustainment base influenced by budget and emerging business models. The fruits of Air-Land Battle, and its DOTMLPF implications, were visible throughout the formations to deploy and fight. The empowerment of the combatant command was evident with Central Command (CENTCOM) and its activities. The sustainment of forces during both operations was an amalgamation of centralized strategic logistics and an emerging operational logistics structure. As the United States begins to conduct an era of expeditionary warfare, the term operational logistics begins to enter the lexicon of commanders and sustainers.<sup>103</sup> The importance of the Air Land Battle equipped force, like the Victory Plan Army before it, is it continues to form the basis of the force seen today even as efforts continue reorganize for the long war against terrorism. The framework from the DOTMLPF Air-Land Battle Army continues to create the sustainment model for ground forces deployed in operational commander's designated area of operations. Support forward with infinite reach back.

As this emergence begins and continues tensions develop that, accelerate and strengthen operational level logistics. The tension of limited defense dollars and the realities of the post cold war force structure exert pressures to maximize force structure and become leaner and more efficient in the sustainment of forces. From the post cold war drawdown, to the stability operations of Somalia and Haiti, and the peace enforcement in Bosnia and Kosovo there is

---

<sup>103</sup>William G. Pagonis, *Moving Mountains: Lessons in Leadership and Logistics for the Gulf War* (Boston, MA: Harvard Business School Press, 1992). There is not a specific reference to the term operational logistics but Pagonis represents the one of the first operational logisticians not only responsible for the ground force logistics but include the air component and serves as the single source point of entry for logistical execution and coordination for CENTCOM's logistics. Operational logistics was still emergent and the Cold War strategic sustainment model still in effect but awareness over contracting, infrastructure and Host Nation Support (HNS) increased exponentially. Just as CENTCOM and 3d Army--Army Central (ARCENT) was responsible for operational planning the pickup logistics team that would manifest in the 22d Support Command was responsible for operational logistics as designated by Commander, CENTCOM and Commander, ARCENT.

tension that has emerged to maximize the force structure to put as much combat power in the Tooth to Tail Ratio equation.

These dual tensions served as a forcing function empowering the operational logistician and in turn the generating force at the strategic logistics level to seek alternatives to support expeditionary operations. The leaner strategic logistics base and the empowered operational level logistician are forced to compensate for the dual tensions that do not relieve the logistics base to provide sustainment and services. This environment where combat forces are maximized and sustainment and service functions are contracted to the Host Nation or a variety of PMCs becomes a repeating model for operations. Reinforcing this emerging model is the fact that PMCs ultimately provide a cost savings to DOD and troop savings to the combatant commander that in an accounting sense looks great on paper.<sup>104</sup>

### **Tooth to Tail Ratios (T3R)**

Tooth to Tail Ratios grew rapidly in World War I to account for the massive requirements in consumption of the new formations and weapons systems. The integration of technological innovations such as the machine gun, the truck, the tank, and artillery created a tail of support personnel required much greater than the traditional supply trains and depot system of the foot infantry and cavalry forces of the preceding era. Interestingly T3R has remained generally constant since World War I.

The mobilization of millions of men created a need to care, rest billet, entertain, and tend to the needs of these soldiers as they conduct combat operations. These life support functions, though complementary to logistics, strengthens the tail requirements of any expeditionary

---

<sup>104</sup>Using the DOD math of 1.2 billion dollars per 10,000 soldiers to add and maintain in force structure, the “Cost Plus” contracting with PMCs like Kellogg Brown and Root (now known and called by its acronym KBR) at the macro level are cheaper to continue than maintain force structure. From 2002 to 2004, KBR earned 11.4 billion dollars utilizing upwards of 60,000 contractors and third country nationals to provide services. The equivalent of force structure cost would be 21.6 billion dollars. DOD saved 10.2 billion dollars in a very conservative estimate.



force.<sup>105</sup> Compounding the tail requirements is the increase in Headquarters and Administration personnel. Looking at the logistics and life support tail from France 1918 to Vietnam in 1968, the number of troops in providing logistics and life support has ranged from 35 percent in 1968 Vietnam; 37 percent in 1950 Korea, 39 percent American Expeditionary Force in 1918; and 45 percent in 1944 Europe (see figure 6).<sup>106</sup> The advent of motorization and mechanization reinforces the growing tail requirements established in World War I.

The interesting trend is the increase of life support personnel as a category. The growth generated by the replacement of individual soldiers in the 1944 ETO, the rotation of individuals into fixed units in Korea and the individual rotation of soldiers in Vietnam creates a need for infrastructure and troops to man life support installations. The massive infrastructure associated with our presence in Iraq stretches back to the AEF of 1918. Vietnam becomes significant with the much greater use of PMCs to make up for an initial shortfall of military engineers and engineer troops needed to create the life support infrastructure. The pressing need to get as much combat power in theater starting in 1965, led the services to turn to PMCs to create the infrastructure and services necessary to support the growing U.S. presence.<sup>107</sup> The requirements to utilize PMCs begin to underscore the tension even as early as Vietnam to bring as many combat units versus other types of units to the fight.

---

<sup>105</sup>John J. McGrath, *The Other End of the Spear*, 6.

<sup>106</sup>Though Vietnam T3R is the lowest the amount of headquarters and administration personnel is almost equal to the amount of personnel dedicated to providing life support and logistics.

<sup>107</sup>Kidwell, 16. To make up for a total lack of engineer expertise and military engineer units the services in 1965 turned to numerous construction firm to include Brown and Root, J.A. Jones and others to build airfields, ports, ammunition storage areas, fuel depots, medical and maintenance facilities and lastly headquarters and administration areas.

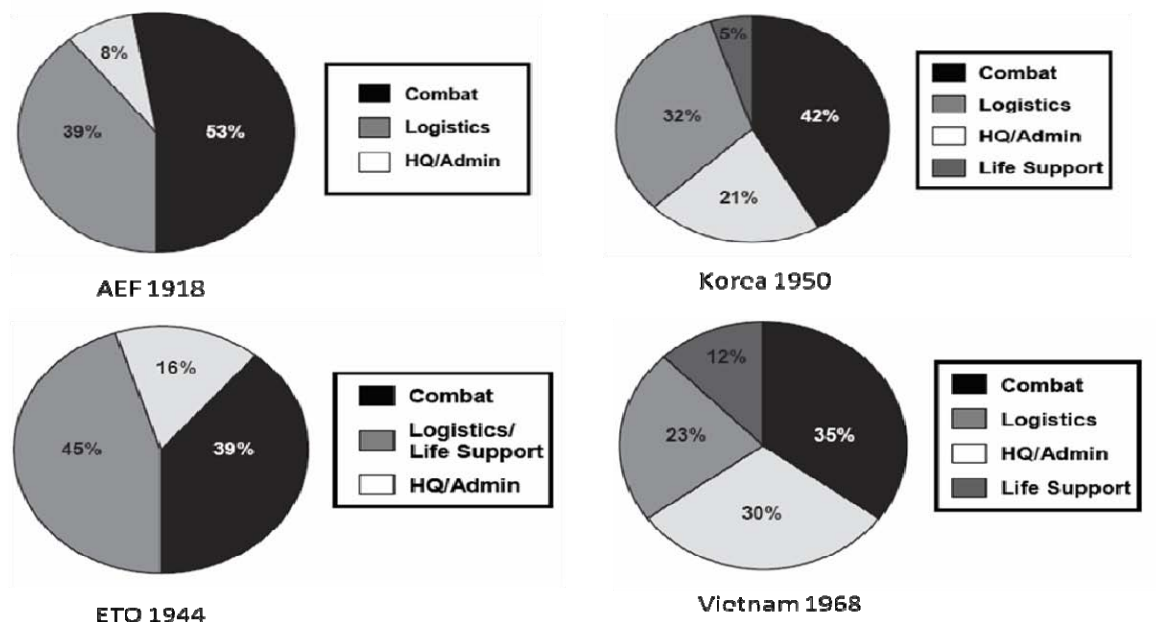


Figure 6. T3R 1918 to Vietnam

Source: John J. McGrath, *The Other End of the Spear: The Tooth-to-Tail Ratio (T3R) in Modern Military Operations*, The Long War Series Occasional Paper 23 (Fort Leavenworth, KS: Combat Studies Institute Press. 2007).

The T3R trends continue on the same trend line that started in Vietnam, with the exception of the Army of Excellence (AOE) division of 1986. The AOE Division does not account for the logistics organizations arrayed behind which provide sustainment to their formations and the deep fight. Kuwait in 1991 gives a good accounting of what the AOE divisions eventually would require for support in operations. It was in the aftermath of Desert Shield and Desert Storm where PMCs became valued added in the intervening years between 1991 and 2003.<sup>108</sup> The modular brigade shows the attempt to standardize sustainment and keep the tail ration at one sustainer to a little over one combat arms soldier.

<sup>108</sup>Ibid., 19. Though critical to the logistics support of units in Desert Storm and Desert Shield it was not conscious effort to substitute PMCs to provide like capabilities to save force structure for combat arms units.

Iraq in 2005 is a deceptive number, as it does not include the conservative estimate of 60 thousand contractors providing services and life support (see figure 7).<sup>109</sup> Iraq 2005 represents the tension of maximizing combat power at the expense of logistics units by the use of PMCs to provide essential infrastructure, logistics, and life support.

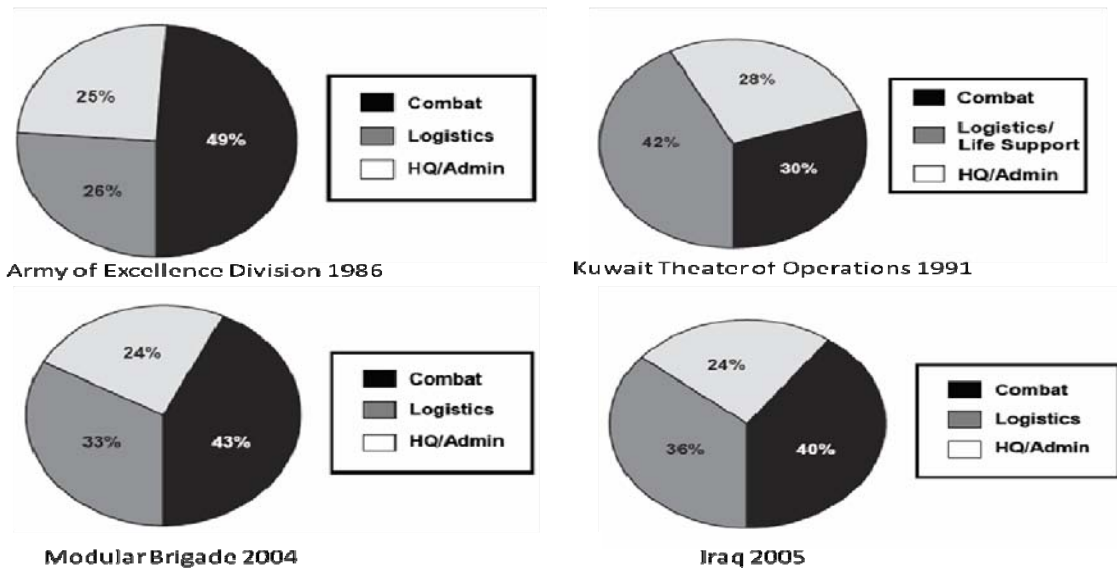


Figure 7. T3R Ratio 1986 to Iraq

Source: John J. McGrath, *The Other End of the Spear: The Tooth-to-Tail Ratio (T3R) in Modern Military Operations*, The Long War Series Occasional Paper 23 (Fort Leavenworth, KS: Combat Studies Institute Press. 2007).

## Modularity and the Generating Force

The United States Army made a decision in 2004 to adopt the modular self-contained brigade combat team army wide. The adoption of the modular brigade was the first step in completely modularizing the entire operational force. The Divisional headquarters would now serve as a Command and Control (C2) node that would receive a number of modular brigades

<sup>109</sup>McGrath. *The Other End of the Spear*, 52.

based on the mission assigned.<sup>110</sup> The cascade effect of this decision, which was in line with the larger efforts of the Department Of Defense, meant that aviation; combat support and sustainment units would also travel the path of modularization. The pressure of creating a lean force structure focused on combat power was immense. This pressure, reinforce the use of PMCs to mitigate the leaner sustainment formations emerging in the modularity reorganization.

The U.S. Army's force structure since WW II had been constantly evolving with the 1950s Pentomic Groups; the 1960s the Reorganization Objective Army Division Brigade; the Forward Deployed Brigade's during the 1970s and 1980s; the Army of Excellence (AOE) Brigade of Air Land Battle; the Force XXI Brigade of the 1990s and recently with the Stryker Brigades.<sup>111</sup> The U.S. Army's decision in 2004 implicitly made the modular Brigade Combat Team the intersection of where the operational and tactical level of war blended. Modularity fundamentally reduced the C2 headquarters available for operational logistics above the Brigade Combat Team's Brigade Support Battalion. Currently, the glide path for complete modularity transformation from 36 Active Component Division Support Commands and Corps Support Groups to 15 Active Component Sustainment Brigades is almost complete (see figure 8).<sup>112</sup>

Secretary of Defense Gates in his recent 6 April 2009 statement on Budget matters addressed a factor that enable the growth of operational sustainment and it relates directly to the organization of the strategic and generating base of our Defense institutions,

Our struggles to put the defense bureaucracies on a war footing these past few years have revealed underlying flaws in the priorities, cultural preferences, and reward structures of America's defense establishment. A set of institutions largely arranged to prepare for conflicts against other modern armies, navies, and air forces. Programs to directly

---

<sup>110</sup>McGrath, *The Brigade*, 134.

<sup>111</sup>Ibid., 77-137. Dr. McGrath discusses the brigade structure within the divisional reorganizations from 1950s onward. It is not seen until the Stryker Brigade a truly self-contained brigade. The modular BCT is not dependent on the traditional AOE divisional slices of supporting units to enable the brigade to complete its assigned mission.

<sup>112</sup>Guy C. Beougher, "Improving Division and Brigade Logistics in the Modular Force," *Army Logistician Magazine* (May June 2006), [http://www.almc.army.mil/alog/issues/May-June06/improve\\_brig\\_log.html](http://www.almc.army.mil/alog/issues/May-June06/improve_brig_log.html)

support, protect, and care for the man or woman at the front have been developed ad hoc and funded outside the base budget.<sup>113</sup>

This set of underlying flaws has enabled the operational logistician to expand the use of PMCs to compensate for the lack of strategic reach back. A new dynamic is immediate identification and demand to the strategic generating force and industrial base for changes in the protection and care of the man and woman at the front above the scope of what was commonplace 20 years ago.<sup>114</sup> The just in time logistics model and the lean nature of the industrial base and strategic level of logistics meant and inability to provide timely support reinforcing the use of PMCs. Risk must be recognized as a planning requirement for sustainment of forces in full spectrum operation.

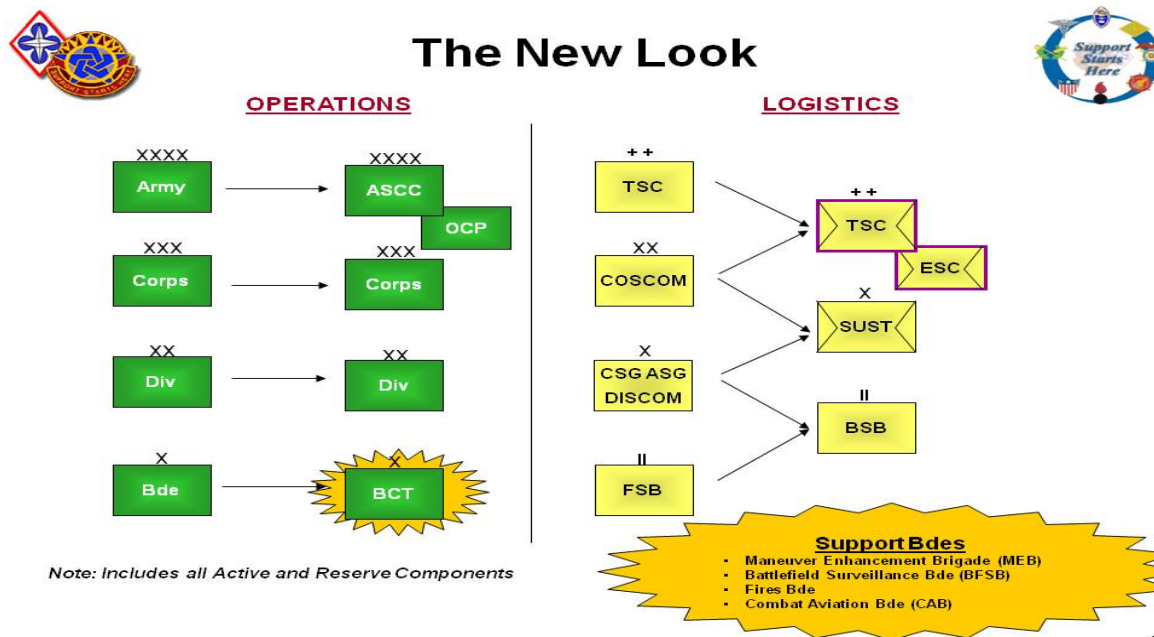


Figure 8. Flattening of C2 Structures  
Source: CASCOM Modularity Brief; November 8, 2008.<sup>115</sup>

<sup>113</sup>Robert M. Gates, Budget Press Briefing, April 6, 2009.

<sup>114</sup>A consistent criticism being echoed by Defense Secretary Gates in the generating force is not on a war footing similar to the combatant commands fighting the long war against terrorism

<sup>115</sup>This briefing is the internal CASCOM Command Brief given to Army Leadership. This briefing is usually part of the standard briefing products the CASCOM Commander or the Army G4 uses to educate and inform.

## The Emergence of Private Military Companies as the Default Sustainer

PMCs are not new phenomena. Private Military Companies refers to contractors that employ and manage civilian personnel in areas of active military operations. Deborah Kidwell in her Global War on Terror Occasional Paper, *Public War, Private Fight? The United States and Private Military Companies* discusses the historical trends of PMCs and U.S. Logistics and the commonplace use of PMCs to provide sustainment and services. The PMCs are becoming more and more visible and varied as the limitations of force structure are addressed.<sup>116</sup>

Contractors, sutlers, entrepreneurs and camp followers have always trailed and sustained armies in combat. Usually this motley assortment of businesses and characters were meeting shortfalls and inadequacies of the military supply system. The rotted salted meats and substandard hard tack were many of the litany of issues both good and bad that are drawn from the early years of the American Civil War.<sup>117</sup> Fundamentally, though, this disparate group of businesses and individuals were filling a critical shortfall that sustained armies operating above the forage level.

Logistics Civil Augmentation Program (LOGCAP) is the Department of Defense program executed through Army Material Command and Defense Contract Management Agency to support global contingency operations by leveraging corporate assets to augment army and joint current and programmed infrastructure and sustainment force structure.<sup>118</sup> LOGCAP is intended to be a sustainment enabler for current and future forces and have the ability to support three simultaneous events globally in a combatant commander's area of operations.<sup>119</sup>

---

<sup>116</sup>Kidwell.

<sup>117</sup>Weigley Russell, *Quartermaster General of the Union Army* (New York, NY: Columbia University Press, 1956), 184-185. The continual theme working with the various contractors in the Civil War is oversight and opportunism. The greater the need for an item to be supplied to the Union forces the greater the chance of corruption.

<sup>118</sup>Army Material Command (AMC) and Defense Contract Management Agency (DCMA) are two institutions that are part of the Strategic Sustainment structure that seamlessly moves between all levels of logistics-- that is Strategic, Operational and Tactical. AMC is pushing more and more of its organization into the operational logistics structure and in some cases embeds itself at the tactical level.

<sup>119</sup>John Brackett, U.S. Army Material Command, Logistics Civil Augmentation Program (LOGCAP), Brief to SAMS, 23-24 March 2009.

LOGCAP and the various attempts to contract shortfalls in sustainment capability today are in line with historical trending from Frederick the Great and the use of sutlers to Military Assistance Command--Vietnam's work with multinational corporations like KBR. LOGCAP today is the sutler from the Civil War sellinghardtack out of the back of his wagons and from his suppliers just on a vast scale and just in time.

The continuing use of LOGCAP and the substitution of civilian business corporations reinforce the model of maximizing combat power at the expense of logistics units. The pressure to gain as much teeth in the T3R ratio by a combatant commander coupled with a declining industrial base and reactive strategic level of sustainment introduces risks to the sustainment of forces. The model of PMC use currently in place works well for counter insurgency and stability operations in the Iraqi and Afghani theater of operations. There is an attempt to mitigate the risk entailed by the use of LOGCAP by using the robust modular sustainment unit's C4 structure and information architecture to plug in non-military logistics capability or host nation support.<sup>120</sup>

There is also a new dynamic of who is actually providing services and life support on the battlefield through the PMCs. It is Indians who drive our trucks; Philipinos who cook our food; Bangladeshis who launder our soldier's gear; and South Africans and Ugandans who stand watch on our walls to enable our limited forces to operate outside the wire maximizing the forces deploy by reducing our T3R.<sup>121</sup> You add British and American Security Contractors to Multi-National

---

<sup>120</sup>The mitigation is the Standard Army Management Information Systems (STAMIS) and the modular sustainment architecture that provides the capability to plug in LOGCAP sustainment and services into the STAMIS network and the military oversight provided by the technical experts that monitor and provide technical oversight to the LOGCAP contractor providing the service.

<sup>121</sup>The term for all the third country nationals providing the labor for contracted sustainment is called "Star Trek Effect" re: LOGCAP originated in the 1<sup>st</sup> Calvary Division headquarters during OIF IV. The quote is unattributed but anecdotally encapsulates the citizens of many nations participating as contracted workers in sustaining our forces in the many theaters of operations.

Corporations applying a cost plus business model, the PMC is now essential to the sustainment of forces on a full-spectrum battlefield.<sup>122</sup>

The “Three Block War” attributed to Marine General Krulak is relevant and illustrates the risk of using business model PMCs for the sustainment of forces.<sup>123</sup> Currently, tactical sustainers are now only operating in the “hot block.” Critical is the role of the Administrative Contract Officers who now need to be mindful of insurance costs of commercial contracted sustainment when providing LOGCAP in a high threat areas or areas that rapidly become high threat. The reliability of sustainment through LOGCAP efforts in a rapidly shifting battlefield must be questioned.

OIF operations continue to cut logistics forces from the force structure and replace their capabilities with LOGCAP; a practice called off ramping. Further analysis is critical in the “bean counting” of off ramping military sustainment units to LOGCAP.<sup>124</sup> MG (R) James Simmons, then III Corp DCG--Support, stated the surge and the sustainment effort was potentially fatal to the logistics corps as an institution due to the logistics structure remaining unchanged from late 2003 through the spring 2007. During the surge period of 2007 and early 2008, the logistics structure continued off-ramping capability to KBR and other PMCs. His concern was the institutional bean counters would look at the bottom line of current operations and not see a need for units being off-ramped in the future.<sup>125</sup>

---

<sup>122</sup>John McGrath, *The Other End of the Spear*, 78. Dr. McGrath notes that the increase of life support personnel and the expectation of full amenity support bases has led to an increase of contractors on the battlefield providing contracted sustainment.

<sup>123</sup>Charles C. Krulak, “The Strategic Corporal,” *Marine Magazine* (January 1999). General Krulak postulates a model of warfare that in a three block area, one block could be peace keeping operations, the next block could be a humanitarian operation and the third block is a high intensity combat operation where the strategic corporal is making decisions that are not only tactical but now strategic in nature.

<sup>124</sup>Off ramping is redeploying units to home station and replacing them with LOGCAP.

<sup>125</sup>MG (R) James Simmons conducted a series of logistics unit visits during the surge period and this was a central theme in his discussion with logisticians in a stated attribution environment. August 16th 2007, Q-West Air Base, Iraq.



The conservative figure of 60,000 contractors on the battlefield was much cheaper than adding troop end strength, which generally cost 1.2 billion dollars to add 10,000 soldier, sailors, airmen, and marines.<sup>126</sup> If force structure is cut in the generating force based on off ramping of units in OIF, then risk is entailed for future operations in permissive and no permissive environments. Current LOGCAP usage is trending realized in the Balkans and extended to Operation Iraqi Freedom in 2003. The original 10-year LOGCAP contract was harshly criticized for its cost but when compared to bringing comparable force structure, LOGCAP becomes an actual bargain. A cost plus contract to bean counters, in a bureaucracy, is much cheaper than maintaining force structure.

### **The United States and the Future of Operational Logistics**

Our troops are drowning in “stuff”. Mountain-high pallets of bottled water in the desert. Cat scanners in a tent city. On-line “cafes” amid the IEDs. 3,000-calorie dinners in the middle of nowhere. Bar-codes on everything from ammo boxes to boxes of plastic forks. We joke about this surfeit of things, and how it makes our military slow and plodding. In truth, they can go almost anywhere in the world and in hours clone almost any landscape in America, from the sewage and power systems to the communications and food. There has never been any logistics remotely comparable to that of the present-day American military.<sup>127</sup>

– Victor Davis Hanson

Operational logistics will continue to expand. The PMC is part of the sustainment landscape. Couple the PMC with the decline of the industrial base; there will continue to be a reactive strategic logistics structure capable of sustaining limited spectrum operations. Logistics support in whatever guise will continue to benefit the interaction technology plays in shaping force structure. The force that a logistician will support continues to integrate quickly spiral

---

<sup>126</sup>James J. Carafano, *Private Sector, Public Wars. Contractors in Combat--Afghanistan, Iraq and Future Conflicts*. Page 54. The Figure is also stated in Congressional Budget Office Estimates for FY 2007 published in October 2006.. Additionally, The International Institute for Strategic Studies in their report, *Expanding the US Army-- Volume 13, Issue 1-- February 2007, uses this figure based on the CBO estimates from October 2006*. This number is considered on the low side of estimates as it does not account for the rising cost of health care or the facilities, barracks, and housing required for the additional end strength.

<sup>127</sup>Hanson.

technologies from weapons programs still in development. The increase in awareness and lethality of our forces will reinforce and enhance the modularity of units. The most apt description of the lethality and type of force the U.S. is fielding is Vladimir Slipschenko's concept of Sixth Generation Warfare. Slipschenko's contends Sixth Generation Warfare is the model of warfare the U.S. seeks to fight. Sixth Generation Warfare started with the Persian Gulf War of 1991; that is the first remote, non-contact war that relies on precision versus overwhelming force structure.<sup>128</sup>

The argument against the United States fighting a remote, non-contact is the need for forces on the ground for operations like Iraq and where one cannot fully employ the remote non-contact war that plays to the technological strengths one can bring to bear on the battlefield. This need for boots on the ground means that one must take risk in the type of forces available for the nation to fight its conflicts and win wars. The growth of contracted logistics and non-standard acquisitions and sustainment dovetails into conceptual framework of the remote, non-contact war. Our enabling of the operational commander to fill the gaps of force structure through instruments like LOGCAP are echoed in Marshal Tukhachevsky's comments on logistics, "The commander must see to it that the logistics system firmly guarantees the resupply of forces with essential commodities whatever turn the situation may take."<sup>129</sup> Consequently, operational commanders will use the tools available in the operational logistics world to maximize his combat power and properly sustain his forces (see figure 9).

Operational logistics has emerged. The tension between maintaining a lethal force structure and the logistics forces necessary to sustain that force will continue to be an issue. The generating force will struggle with budgetary pressures and limits to troop strength on the ground. As the U.S. continue to seek the continuation of remote, precision war, there will be the continued

---

<sup>128</sup>Makhmut Gareev and Vladimir Slipchenko, *Future War* (Fort Leavenworth, KS: Foreign Military Studies Office, 2005), 12-17.

<sup>129</sup>Richard E. Simpkin, *Deep Battle*, 174.

use of PMCs due to the cost effective nature of those types of organizations and the capabilities they can provide.

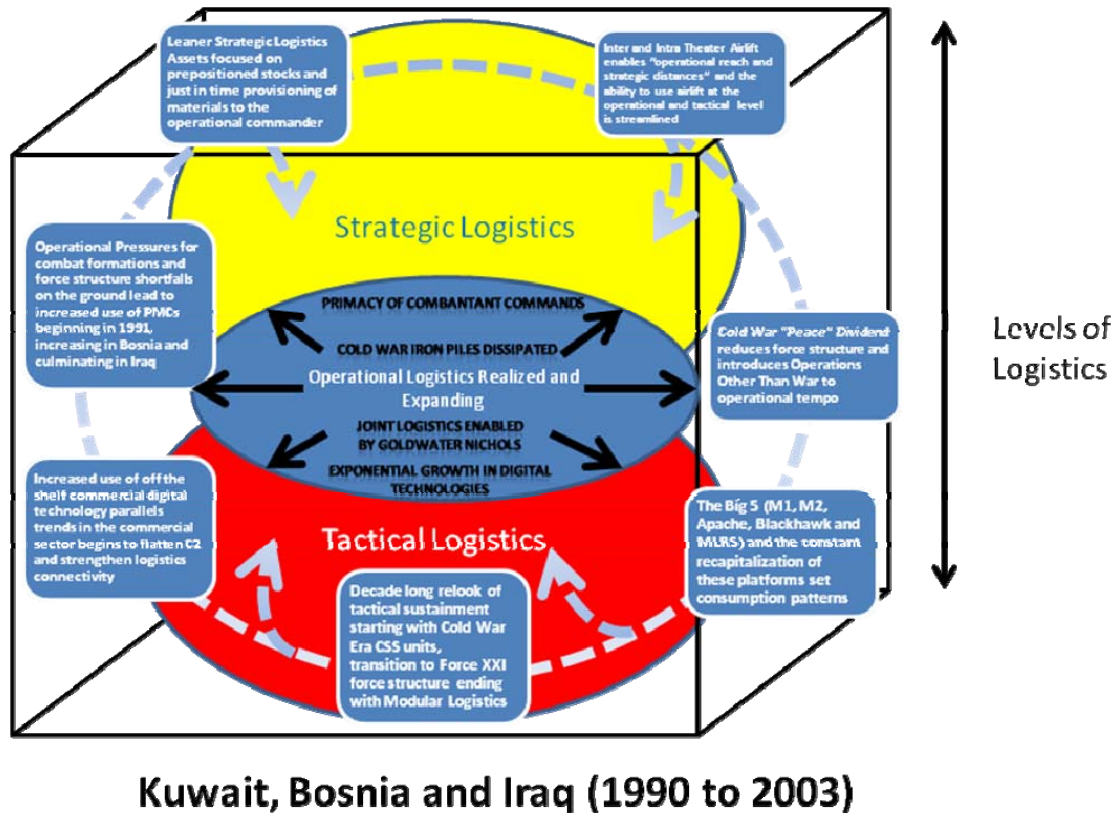


Figure 9. Operational Logistics 1991 to Present

Source: David S. Alberts, John J. Garstka, Richard E. Hayes, and David T. Signori, *Understanding Information Age Warfare* (Washington, DC: DOD Command and Control Research Program (CCRP), 2001), 108.<sup>130</sup>

The ability to counter the remote, non-contact war model and the need for boots on the ground is Martin Van Creveld's who states, "the visions of long-range, computerized, high tech warfare so dear to the military industrial complex will never come to pass." What reinforces his point is that complex environmental factors and an adaptive adversary will mitigate precision

<sup>130</sup>This diagram technique demonstrates the forces that contributed to the expansion of the operational sphere of logistics during the post Goldwater-Nichols period leading up to the start of combat operations in Iraq and Afghanistan.

weapons employment. The complex environment of cities and other constricted battlegrounds will remain a battleground of the present and the future.<sup>131</sup> These current and future environments will place extraordinary pressures on the operational commander for the maximum amount of combat power reinforcing the use of PMCs and contracted sustainment.

## Conclusion

The emergence of operational logistic is a recent phenomenon (see figure 10). Logistics until World War II was dependent on the horse and wagon and hamstrung from moving essential materials and services from the railhead, port, or beach. The advent of motorization radically changed how armies were sustained and broke the tyranny of Napoleonic logistics of depots, forage, foot march, and of course the horse and wagon. The struggle since World War II was the synthesis of technology, improvements in C4, and force structure that leveraged motorization and other improvements in transportation technology. This synthesis enables the operational commander to sustain his forces in reach, simultaneity, and depth.

---

<sup>131</sup>Martin Van Creveld, *The Transformation of War* (New York, NY: The Free Press, 1991), 212.

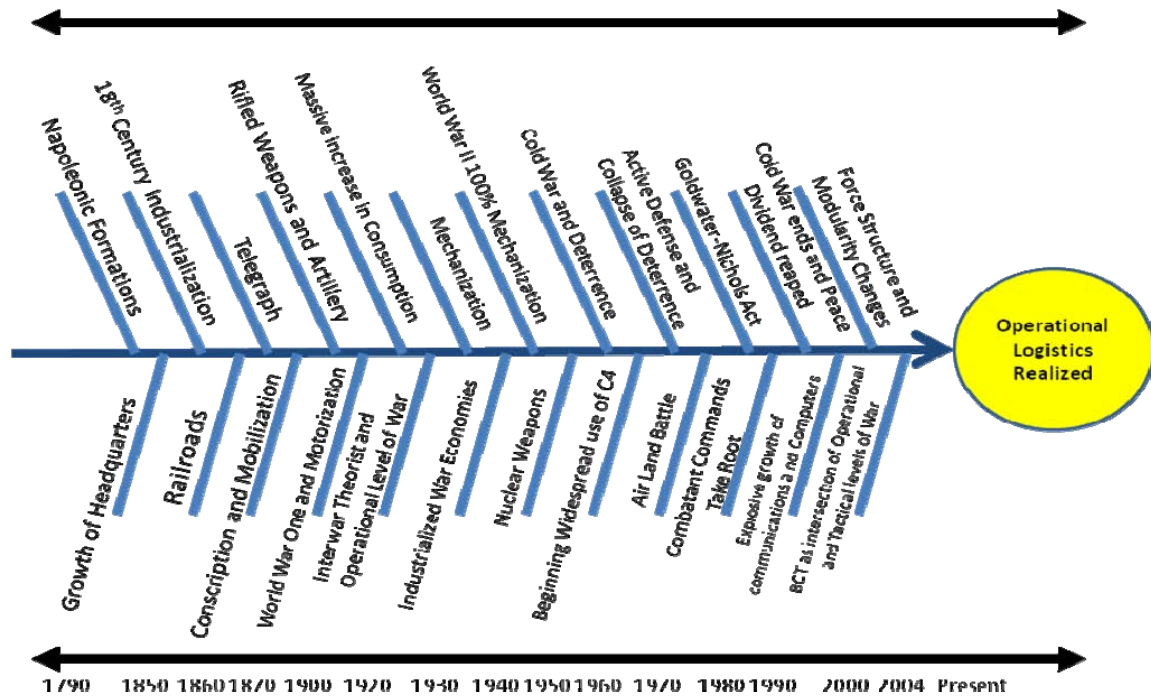


Figure 10. “Operational Logistics Realized”<sup>132</sup>

Risk is now inherent in our sustainment of forces. The empowerment of the combatant commanders and the tools enabling them to sustain their forces and operations have created a new dynamic in balancing tooth to tail to maximize combat forces. The use of PMCs gives the combatant commander the ability to shed uniformed logistics structure to maximize combat troop strength. The current use of PMCs works well in the Krulak model of “the three block war” but does their employment work in a non-permissive combat environment? The off ramping of logistics units creates a perception that uniformed logistics are redundant and ultimately unnecessary in a combatant commander’s area of operations. Still, PMCs are an enabler for a combatant commander in today’s current operations. PMCs permit the life support and

<sup>132</sup>The fishbone diagram demonstrated causality of technology, places or key events in order to demonstrate the emergence of operational logistics.

sustainment without increase of T3R. The conservative estimate of 60,000 contractors on the battlefield in Iraq creates the ability to maximize combat power.

Risk is amplified by the decline to the military industrial base. This decline is reinforced by the “just in time” logistics model that parallels business models of the late twentieth century and today. This decline plus the continued use of PMCs will keep the realm of operational logistics as the agent of change. The march to emergence of operational logistics has its roots back in the Victory Plan army of World War II and the total motorization of force. The logjam from the railhead, port, beach, and airfield is resolved by the reach of strategic transportation systems pushed down into the operational and tactical levels of logistics. Full motorization is complete. C4 now can synchronize sustainment at the operational level to enable reach, depth, and simultaneity of logistics to operational forces.

The Soviet operational theorists, of the interwar period, were correct with the importance of integrating technology into force structure. The realization that motorization was essential to break the massive numbers of horses and wagons required to sustain the new mathematics of consumption. The motorization of support for mechanized units was essential to breaking the paradigm of moving materials from the railhead. The Wehrmacht remained hindered on the Eastern Front by not motorizing their logistics. The full motorization of Soviet forces in 1944 led to continuous successive operations without pause ending in the capture of Berlin and the end World War II.

The stifling blanket of deterrence did not ultimately suppress the emergence of the operational level of logistics. The nuclearization of all things tactical led to the rediscovery of the Soviet operational theorist in the 1970s by the Red Army. The rediscovery, driven by the need for conventional alternatives on the battlefield, created an environment for change. The employment of successive echelons of operational forces able to conduct independent deep penetration operations invalidated Active Defense in central Europe. The western and American reaction to the deep Soviet echelonment led to the Air Land Battle doctrine powering DOTMLPF changes

throughout the Army. The Big 5 procurement programs give the forces seen today on the battlefield.

Headquarters and C4 growth is fundamental for the emergence of operational logistics. The Napoleonic headquarters of the corps and division established the framework to free the commander from the day-to-day details of sustaining his forces. The advent of the telegraph and railroad continued the growth of the headquarters and brought strategic surety to the movement and sustainment of forces. The linking of industrial capacity to the armies distributed across multiple theaters of operations became possible. The British in the Boer War and the Russians in the Russo-Japanese War of 1904 demonstrated the movement of forces, across strategic distances. The new formations and weapons of World War I continued the growth of the headquarters and creates demands for support that established the T3R seen today.

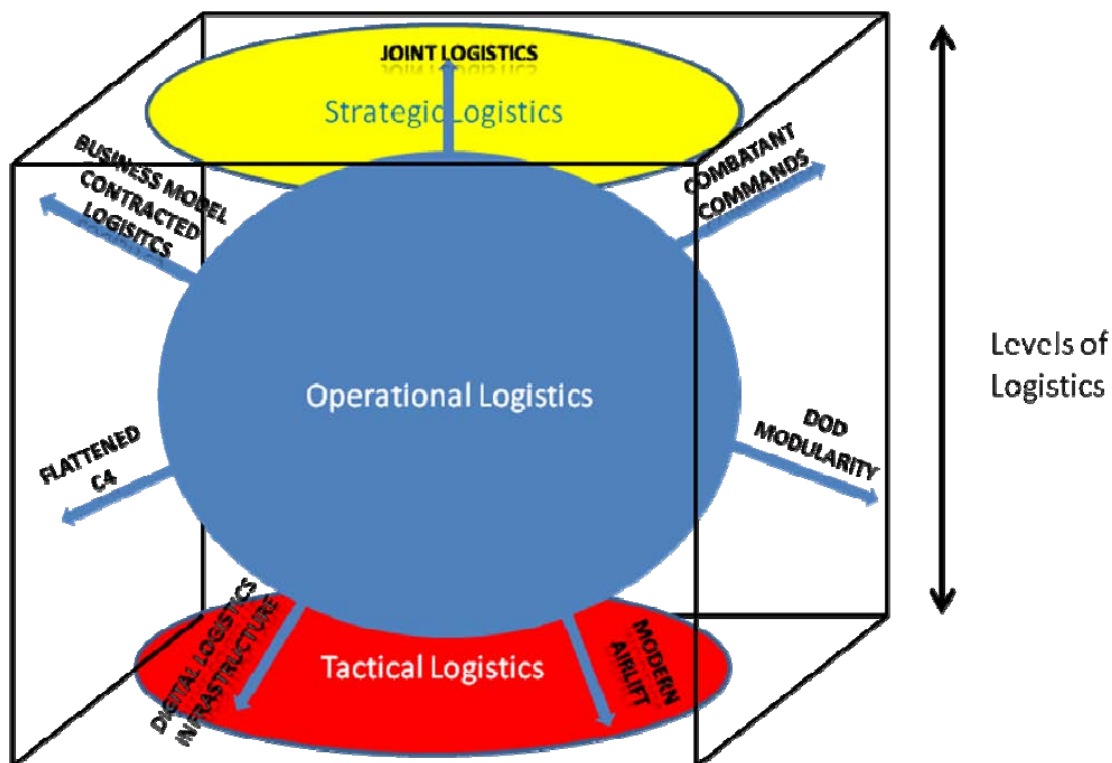
The current conflicts in Iraq and Afghanistan are highlighting an emerging trend in the operational level of logistics seen in the flattening of distribution, acquisition, contracting, and sustainment. Combatant Commanders continue to exercise the authority to shift logistics resources in their respective theaters. The risk is the balance of force structure available to combatant commanders is not sufficient for future expeditionary and contingency operations. The current sustainment model has evolved over the past two decades of permissive contingency environments and limited force structure. Uniformed logistics units can sustain initial combat operations in the short term but in the long term high intensity operations are only possible with LOGCAP. General Rupert Smith's Interstate Industrial War might not be possible to fight with today's military industrial base and just in time logistics.

The current operational logistics construct of PMCs substituting for logistics force structure is a reality. Analysis of force structure and the effects of off ramping is an area of future analysis. What is critical is understanding the risk entailed by the use of PMCs in the current operating environment. What is the future role of PMCs in formulating force structure in the next contemporary operating environment? The continued use and planning PMCs to bridge shortfalls

in logistics force structure impacts DOTMLPF and the budgets of DOD in the out years (see figure 11).

The emergence of operational logistics is a recent phenomenon. The departure from the horse and wagon logistics model during the interwar period capitalized on the interaction of force structure, technology, and C2. The advent of the computer and long-range transportation greatly enhanced the operational commander's sustainment reach, depth and simultaneity. The intellectual growth from the 1970s precipitated by the need for conventional solutions to nuclear escalation brought about the DOTMLPF changes to force structure and equipping that gives us the footprint of units today. The sustainment model of Desert Shield and Desert Storm represents a seam between the Industrial World War II model and the just in time logistics model today. The combatant commander's problem of limited force structure has enabled the recent growth of PMCs and cemented their place in operational logistics. Risk is now a permanent part of operational math required to support campaigns and operations.





## 2004 to Present (Expansion of the Operational Sphere of Logistics)

Figure 11. 2004 to Present (Expansion of Operational Logistics)

Source: David S. Alberts, John J. Garstka, Richard E. Hayes, David T. Signori, *Understanding Information Age Warfare* (Washington, DC: DOD Command and Control Research Program (CCRP), 2001), 108.<sup>133</sup>

## Recommendations

Use of PMCs makes sense in today's campaigns in Iraq and Afghanistan. PMCs enable the combatant commander to maximize limited force structure for long-term operations. Analysis of off ramping and the force structure implications of LOGCAP is critical for the long-term health of the sustainment structure. The critical point in the baseline of modular force logistics force structure represented by the 15-sustainment brigades available for expeditionary operations.

<sup>133</sup>This diagram technique demonstrates the forces that are contributing to the expansion of the operational sphere of logistics as we see it today.

This is reduction by over half of what was previously available for expeditionary operations before modularity. There cannot continue to be a reduction of the logistics force structure based on the current operational environment and the cost savings entailed by long term LOGCAP contracts.

Risk must be addressed as part of operational logistics. The current operational logistics model is based on the heavy use of LOGCAP dependent on a non-permissive environment. The generating force must answer the critical issue of whether uniformed force structure is available for long-term expeditionary operations operating in non-permissive environments. The leanness of the military industrial base and the reactive nature strategic logistics entail great risks which be compounded by the potential failure of LOGCAP to provide the necessary services and logistics in full spectrum operations.

It is critical for operational and tactical commanders to be familiar with contracting on the battlefield and its complementary tie in Money as a Weapons System as part of their familiarization with their operating environment.<sup>134</sup> Additionally extensive staff training on the actual functions and regulations of LOGCAP and battle fielding contracting is essential. It is essential that competent personnel are selected with managing the functions and services provided by the PMCs.

There is lack of material and dialogue on the criticality of sustainment and transportation and its interaction with the Elements of Operational Design here at the School of Advanced Military Studies. SAMS is the only school in the U.S. Armed Forces focused on the Operational Art. Conceptualization of the operational math is critical to the success of both planner and the command. Even more lacking is the focus on operational logistics in the readings, practicums, case studies, and instruction throughout the academic year. Operational logistics and the required

---

<sup>134</sup>Money as a Weapons System is a booklet produced by an amalgamation of agencies and published by Multi-National Corps - Iraq that educates the staff officer on all the types, colors and flavors of money, contracting and LOGCAP at the disposal of the unit. Additionally the booklet lays out what guidelines govern the dispersal of government funds.

operational math and sums will challenge all Tier 1 and Tier 2 planners immediately in their execution of duties.

Logistics, specifically operational logistics, is fundamental to the Nation's ability to project forces and conduct operations to meet the strategic goals set by our duly elected political leaders and the President of the United States and his administration. The importance of sustainment is critical to the development of Tier 1 and Tier 2 planners for the operational Army and the Combatant Commands. Officers, regardless of their specialty are expected to synthesize force deployment, transportation synchronization, and basic time distance factors to make relevant the forces deployed to meet strategic end state. Comprehending and envisioning operational logistics enables successful execution of combat operations.

# BIBLIOGRAPHY

## Books

- Alberts, David, and Richard Hayes. *Power to the Edge: Command and Control in the Information Age*. Washington, DC: Department of Defense, Command and Control Research Program, 2003.
- Alberts, David, John J. Garstka, Richard E. Hayes, and David T. Signori. *Understanding Information Age Warfare*. Washington, DC: Department of Defense, Command and Control Research Program, 2005.
- Atkinson, Simon, and James Moffat. *The Agile Organization: From Informal Networks to Complex Effects and Agility*. Washington, DC: Department of Defense, Command and Control Research Program, 2005.
- Axelrod, Robert, and Michael Cohen. *Harnessing Complexity: Organizational Implications of a Scientific Frontier*. New York, NY: Perseus Press, 2000.
- Bacevich, Andrew J. *The Pentomic Era*. Washington, DC: National Defense University Press, 1986.
- Barnett, Corelli. *The Sword Bearers: Supreme Command in the First World War*. New York, NY: William Morrow and Company, 1964.
- Bellamy, Christopher. *The Evolution of Modern Land Warfare: Theory and Practice*. London, England: Routledge Press, 1990.
- Beougher, Guy C. "Improving Division and Brigade Logistics in the Modular Force." *Army Logistician Magazine* (May June 2006). [http://www.almc.army.mil/alog/issues/May-June06/improve\\_brig\\_log.html](http://www.almc.army.mil/alog/issues/May-June06/improve_brig_log.html).
- Brodie, Bernard. *Strategy in the Missile Age*. Princeton, NJ: The Rand Corporation and Princeton University Press, 1965.
- Brown, Shannon A. ed. *Providing the Means of War. Perspectives on Defense Acquisition. 1945-2000*. Washington, DC: United States Army Center of Military History and the Industrial College of the Armed Forces, 2005.
- Bucholz, Arden. *Moltke, Schlieffen and Prussian War Planning*. Providence, RI: Berg Publishing, 1993.
- Carafano, James J. *Private Sector, Public Wars. Contractors in Combat--Afghanistan, Iraq and Future Conflicts*. Westport, CT: Praeger, 2008.
- Citino, Robert. *Blitzkrieg to Desert Storm: The Evolution to Operational Warfare*. Lawrence, KS: University of Kansas Press, 2004.
- Clausewitz, Carl Von. *On War*. Edited and Translated by Michael Howard and Peter Paret. Princeton, NJ: Princeton University Press. 1984. *Vom Krieg* was first published in 1832.

- Cosmas, Graham A. *MACV: The Joint Command in the Years of Withdrawal 1968-1973*. Washington, DC: The U.S. Army Center of Military History, 2007.
- Czerwinski, Thomas. *Coping with the Bounds: A Neo-Clausewitzian Primer*. Washington, DC: Government Printing Office, 1998.
- Depuy, Trevor. N. *A Genius For War: The German Army and General Staff, 1807-1945*. Englewood Cliffs, NJ: Prentice Hall Inc., 1977.
- Epstein, Robert E. "The Creation and Evolution of the Army Corps in the American Civil War." *The Journal of Military History* 55, no. 1 (January 1991): 21-46.  
<http://www.jstor.org/stable/1986127?seq=1>
- . *Napoleon's Last Victory: 1809 and the Emergence of Modern War*. Fort Leavenworth, KS: School of Advanced Military Studies, 1992.
- Fall, Bernard. *Hell in a Very Small Place*. New York, NY: Vintage Books, 1968.
- Fuller, J.F.C. *The Conduct of War; 1789-1961*. New York, NY: De Capo Press, 1992.
- Gareev, Makhmut, and Vladimir Slipchenko. *Future War*. Fort Leavenworth, KS: Foreign Military Studies Office, 2005.
- Gordon, Michael, and Trainor, Bernard. *Cobra II: The Inside Story of the Invasion and Occupation of Iraq*. New York, NY: Random House Publishing, 2006.
- Gladwell, Malcolm. *Blink: The Power of Thinking Without Thinking*. New York, NY: Back Bay Books, 2005.
- . *The Tipping Point: How Little Things Can Make a Big Difference*. New York, NY: Back Bay Books, 2000.
- Glantz, David and Jonathan House. *When Titans Clashed: How the Red Army Stopped Hitler*. Lawrence, KS: University Press of Kansas Press, 1995.
- Harrison, Richard. *The Russian Way of War: Operational Art 1904-1940*. Lawrence, KS: University Press of Kansas Press, 2001.
- Hart, B.H. Liddell. *Strategy*. London, England: Faber and Faber Publishing, 1954.
- Hattaway, Herman, and Archer Jones. *How the North Won: A Military History of the Civil War*. Chicago, IL: University of Illinois Press, 1983.
- Herspring, Dale R. *The Pentagon and the Presidency: Civil Military Relations From FDR to George W. Bush*. Lawrence, KS: University Press of Kansas, 2005.
- Jomini, Antoine H. *The Art of War*. Westport, CT: Greenwood Press Publishers. First Published in 1862. Translated from French by CPT G.H. Mendell and LT W.P. Craighill.
- Kahn, Herman. *On Escalation: Metaphors and Scenarios*. New York, NY: Praeger Institute Press, 1965.

- . *On Thermonuclear War*. Princeton, NJ: Princeton University Press, 1961.
- Kidwell, Deborah C. *Public War, Private Fight? The United States and Private Military Companies*. Global War on Terrorism Occasional Paper 12. Fort Leavenworth, KS: Combat Studies Institute Press, 2005.
- Kipp, Jacob W. "Confronting the RMA is Russia." *Military Review* (May/June 1997).
- . *Mass, Mobility And the Red Army's Road to Operational Art 191-1936*. Fort Leavenworth, KS: Foreign Military Studies Office, 1988.
- Kirpatrick, Charles E. *An Unknown Future and Doubtful Present: Writing the Victory Plan of 1941*. Washington, DC: Center for Military History United States Army, 1992.
- Krause, Michael, and R. Cody Phillips,. *Historical Perspectives of the Operational Art*. Washington, DC: Government Printing Office, Center of Military History, 2005.
- Krulak, Charles C. "The Strategic Corporal." *Marine Magazine* (January 1999).
- McGrath, John J. *The Brigade: A History; Its Organization and Employment in the United States Army*. Fort Leavenworth, KS: Combat Studies Institute Pres, 2004.
- . *The Other End of the Spear: The Tooth-to-Tail Ratio (T3R) in Modern Military Operations*. The Long War Series Occasional Paper 23. Fort Leavenworth, KS: Combat Studies Institute Press, 2007.
- MacGruder, Carter B. *Recurring Logistics Problems as I Have Observed Them*. Washington, DC: United States Army Center of Military History. 1989
- Mosier, John. *The Myth of the Great War: How the Germans won the Battles and the How the Americans saved the Allies*. New York, NY: Perennial, 2001.
- . *The Blitzkrieg Myth: How Hitler and the Allies Misread the Strategic Realities of World War II*. New York, NY: Perennial. 2003.
- Murray, Williamson, and Allan R. Millet, eds. *Military Innovation in the Interwar Period*. Cambridge, England: Cambridge University Press, 1996.
- Naveh, Shimon. *In Pursuit of Military Excellence. The Evolution of Operational Theory*. London, UK: The Frank Cass Publishers, 1997.
- Newell, Clayton and Krause, Michael. *On Operational Art*. Washington, DC: Government Printing Office, Center of Military History, 2005.
- Pagonis, William G. *Moving Mountains: Lessons in Leadership and Logistics for the Gulf War*. Boston, MA: Harvard Business School Press, 1992.
- Peppers, Jerome. *History of United States Military Logistics; 1935-1985*. Huntsville, AL: Logistics Education Foundation Publishing, 1988.
- Ricks, Thomas E. *Fiasco: The American Military Adventure in Iraq*. New York, NY: The Penguin Press, 2006.

- Russell, Weigley. *Quartermaster General of the Union Army*. New York, NY: Columbia University Press, 1956.
- Schneider, James J. Theoretical Paper No. 3, *The Theory of Operational Art*, 2nd issue. School of Advanced Military Studies, Fort Leavenworth, KS, March 1988.
- Simpkin, Richard E. *Deep Battle: the Brainchild of Marshall Tukhachevsky*. London, England. Brassey's. 1987.
- . *Race to the Swift: Thoughts on Twenty-First Century Warfare*. London, England: Brassey's, 1985.
- Smith, General Rupert. *The Utility of Force: The Art of War in the Modern War*. New York, NY: Vintage Books, 2008.
- Svechin, Aleksandr A. *Strategy*. Minneapolis, MN: Eastview Press, 1992.
- Thompson, Julian. *The Lifeblood of War: Logistics in Armed Conflict*. London, UK. Brassey's. 1991.
- Triandifillov, V.K. *The Nature of the Operations*. London: Rutledge Press, 1994.
- Turbiville, Graham H. *Soviet Logistics Support Concepts Change*. Fort Leavenworth, KS. Soviet Army Studies Office. 1987. Article that was published in Army Logistician, March--April 1987. Pages 2-7.
- Vego, Milan. *Operational Warfare*. Newport, RI. Naval War College Student Text. Academic Year 2003-2004 issue
- Van Creveld, Martin. *Command In War*. Cambridge, MA: Harvard University Press, 1985.
- . *Supplying War: Logistics from Wallenstein to Patton*. New York, NY: Cambridge University Press, 1977.
- . *The Transformation of War*. New York, NY: The Free Press. 1991.
- Weigley Russell, *Quartermaster General of the Union Army*. New York, NY: Columbia University Press, 1956.

#### Joint Publications and Field Manuals

- Department of the Army. Field Manual (FM) 3-0, *Operations*. Washington, DC: Government Printing Office, 2008.
- . Pamphlet 20-261a, *The German Campaign in Russia: Planning and Operations 1940-1942*. Washington, DC: Government Printing Office, 1955.
- Joint Chiefs of Staff. Joint Publication (JP) 3-0, *Joint Operations*. Washington, DC: Government Printing Office, 2006.
- . Joint Publication (JP) 4.0, *Joint Logistics*. Washington, DC: Government Printing Office, 2008.

———. Joint Publication (JP) 5-0, *Joint Planning Manual*. Washington, DC: Government Printing Office, 2006.

#### Internet Sources

Christianson, LTG Claude V. U.S Army DCS G4, Testimony before the House Armed Services Committee, March 30th 2004.

[http://www.globalsecurity.org/military/library/congress/2004\\_hr/04-03-30christianson.htm](http://www.globalsecurity.org/military/library/congress/2004_hr/04-03-30christianson.htm) (accessed 12 April 2009)

Department of Defense. Publication to Congress and the GAO on FY07 Priorities.

<http://origin.www.gpoaccess.gov/USbudget/fy07/pdf/budget/defense.pdf> (accessed 13 April 2009)

Beougher, Guy C. “Improving Division and Brigade Logistics in the Modular Force.” *Army Logistician Magazine* (May June 2006). [http://www.almc.army.mil/alog/issues/May-June06/improve\\_brig\\_log.html](http://www.almc.army.mil/alog/issues/May-June06/improve_brig_log.html) (accessed 12 April 2009)

Hanson, Victor Davis. “The Good--Part III.” Blog, March 30, 2009. <http://pajamasmedia.com/victordavishanson/784/> (accessed April 6, 2009).